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The Asheville Meeting.

Attention has already been directed to the Asheville meeting of the American Institute of Electrical Engineers, which is to be held at Asheville, N. C., June 19-23. In view of the fact that this is the first visit of the Institute to the South—or any region farther south than Washington—it seems desirable once more to call notice to the subject. An excellent programme of papers has been prepared. and the conditions are all such as to invite and secure a full and serious discussion of the important topics presented, ranging over the whole field of modern electrical work. Meantime the transportation and local committees have been busy, and have done a great deal of work to secure favorable rates and good service, and all the indications point to a large attendance. It is to be hoped that members outside the South will endeavor to be present, and that new interest in the Institute may be aroused in that region, where up to this time it has not been very strong. We welcome all such movements towards decentralization, for while it is always easy to get a large meeting in a city like New York, the best interests of the Institute and the profession are served by visits to such resorts as Asheville, in different parts of the country, in the summer time, so that engineers in every State may have an opportunity to enjoy the meetings and realize all the benefits of professional intercourse.

Rural Electric Traction.

Elsewhere we print an abstract of an Institute paper by Mr. J. R. Cravath, which gives a remarkably interesting analysis of the electric traction problem as related to ordinary rural conditions. Electric traction has thus far been developed along lines involving the exploitation of only the most profitable territory, and its tendency has increasingly been to rival steam lines in speed and track construction. As a consequence, the possibilities of the standard non-urban electric road of to-day are limited either to the connection of important population centers or to extensions from such centers into rural districts more than normally promising with respect to traffic and freight movement. In proposing a wide departure from standard electric traction practice, Mr. Cravath takes the view that if the mountain will not go to Mahomet, the prophet is wise in accepting the situation and himself making the journey—that if standard electric traction practice is not at present adapted for average rural conditions, it must be modified to suit these conditions. While this is heretical from the standpont of the modern standardization creed, according to which the factory with its precious organization must be the arbiter of all development, it is nevertheless common sense. A most interesting feature of the paper of Mr. Cravath is an analysis of the traffic possibilities of rural districts, such as those which the light railway system proposed is designed to serve. The method adopted in this analysis is one which should prove of value in investigating the profitability of extending any system of electric traction into rural districts.

The Electrical Operated Shop.

An unusual example of the application of electrical operation to the equipment of an entire shop plant is afforded in the large new repair shops of the Great Northern Railway at St. Paul, Minn., described elsewhere in this issue. Electrical operation has been applied to all classes of shop details, under widely varying conditions, with uniformly successful results, but it is rare that an installation occurs involving an entirely new design of buildings and equipment,

with a general abandonment of all precedent, so that the opportunity is afforded to adapt the design closely to the conditions for economical operation offered by motor driving. Such is the case, however, at this new shop plant, and departures from usual practice are involved which make the installation worthy of the careful study of shop engineers.

The most striking feature of this installation is the use of an alternating-current distribution of power, and induction motors; even the variable-speed and reversible motors are of the induction type. There has been much difference of opinion as to the relative merits of alternating and direct current for shop distribution and operation, many having claimed that the direct-current system was the only practical method, the other being a make-shift whereby economical results could not be expected. Yet this installation adds another example of the use of the induction motor. The simplicity and reliability of the induction motor were considered as of importance equal to, if not greater, than the somewhat greater flexibility of the direct-current motor. The elimination of the commutator and consequent reduction of wear and attendance, the possibility of continuous and uninterrupted operation under adverse conditions, and the general disregard of abuse, inherent in the induction motor, are factors worthy of consideration. In railroad repair shop work the alternating-current system has been in successful use for considerable periods in such shops as those of the Boston & Maine Railroad at Concord, N. H.; of the Philadelphia & Reading Railway, at Reading, Pa.; of the Michigan Central Railroad, at Jackson, Mich., etc.

No direct-current machinery is involved in the distribution system whatever, all variable-speed operation necessary being provided by variable-speed induction motors. This is being successfully accomplished, as pointed out in the article, and results equal to those obtainable from the direct-current motor are being obtained. In this way the single distribution system is sufficient for all classes of machinery driving and great simplicity is effected thereby. The operating efficiency of the induction variable-speed equipment is, no doubt, somewhat less than that of the variable-speed, direct-current motor, but the advantages of uniformity of equipment and simplicity of the distribution far outweigh the shortcomings as to efficiency; furthermore, efficiency of the electrical driving equipment may be of little significance in comparison with the advantages offered by the changes of speed which are thus made quickly available, as the result of this upon the production of the tools is brought up to the maximum. The methods of application resorted to include both group and individual driving. The group drive method is used in general, especially where tools are used intermittently, and when constant speeds of driving are sufficient for their requirements. In cases of the larger tools, and those isolated so that line shafting of considerable lengths would have to be extended to operate them, the individual drive method is used successfully. The variable-speed individual drive has been installed in a number of special cases where the changing of speeds is beneficial to the production rate of the tool. The variable-speed motor is found to operate very satisfactorily and, like the other features of the installation, meets the peculiar requirements of the railway repair shop work.

WHAT WOULD NEWTON DO?

It is now near two and a half centuries since Isaac Newton, in one of the flashes of intuition that form man's best title to immortality, saw disclosed to him the key to the mysteries of space. It was half a lifetime later when, through years of patient study and waiting, data enough had come to his hands to clear his conscience in announcing his discovery. For very Truth's sake he gave to the world no half-baked hypothesis nor ventured to exploit with specious arguments a doctrine which did not quite meet all the facts. We do things differently nowadays. How would the great discoverer have fared had he occupied the chair of physics at ——— University, where a monthly blank is forwarded to heads of departments to be filled out with reports on the "researches" they have completed and the number of lectures they have given before women's clubs? Would he have held his peace or would he have sent for a reporter of the *Daily Saffron* and have filled him full of speculations on the bounds of space and the origin of life? Would he have cut up his great hypothesis into stove lengths, as it were, to furnish his hustling pupils fuel for frying their theses? Would we have had Prof. I. Newton and Thomas Snoobs, B. S. "On Gravitation in Jupiter," and Prof. I. Newton and Richard Roe, A. B., "On Gravitation in the Saturnian System," and so on *ad nauseam?* And would the President have sacked him for insinuating that something in the universe had a more consistent pull than the Chief Benefactor?

We are moved to these discursive reflections by reading in succession a batch of papers on radium, beginning with Rutherford's most interesting Congress paper, and following it up by an incursion upon recent numbers of the *Phil. Mag.* We are always delighted with the experimental ingenuity of these researches which contrive to make manifest the properties of next to nothing in a very striking fashion, and we are far from denying the possibilities of the working hypothesis assumed by Rutherford and his confreres, but what would Newton have done? Would he have left before developing the results of his hypothesis, any stone unturned that might give him light on its fundamental correctness? Profoundly interesting as are theories of the genesis of the so-called elements, they furnish no adequate excuse for neglecting to examine the elements at hand. Take, for example, the substance radium itself. There is good reason to assign it a definite place among the other elements, and a rational set of chemical and physical properties quite apart from its radioactivity. Who, of all those who have theorized about its radiations, have any knowledge of the physical properties of the metal, with the bromide of which they are daily working? Is there anybody indeed who can affirm from actual knowledge that the metal radium is radioactive at all? Radium salts are, unhappily, costly, the latest newspaper quotation being $3,000,000 per ounce, but the subject is surely of sufficient importance to justify some one in trying to produce a few milligrams of the metal. Again, it seems to be well established that radium salts give off heat spontaneously and steadily, as an accompaniment to their radioactive activity. But there has not yet been any adequate investigation of the actual cause of this thermal energy.

We have had any amount of speculation based on the assumed endothermic properties of radium, including a voluble explanation of the source of the sun's heat and the interior temperature of the earth, but there has not been yet a really serious attempt to determine whether the phenomenon itself is primary or secondary—due to disintegration or to the return of energy received from exterior sources. Everybody seems to have jumped at the former conclusion as the striking and sensational one without further discrimination. Likewise in the case of the radium emanation we have on good authority the appearance of helium as a decomposition of product. Radium has a definite spectrum and so has helium, but although the spectroscopic study of this mysterious evolution of helium ought to show clearly and certainly the whole progress of atomic disintegration, no word has yet come to enlighten us. The true and faithful student of radioactivity seems to hold old-fashioned chemistry as anathema, and the spectroscope, that magic wand that has turned back the veil from interstellar abysses, as a deceit of the Devil. Now

the subject is a tremendously important one—we began this comment intentionally with a reference to gravitation—and it deserves the best efforts of the greatest investigators. The thing which we would impress upon them, however, is that hypothesis needs to have its wings clipped a bit just now. It is well to remember Newton's immortal lesson in scientific self-restraint, and to make sure of one's foundations, before building a new Heaven and a new Earth from anything so elusive as radium emanation.

SHORT SPARK DISCHARGES.

We see so much of long sparks, arcs and spark discharges in practical electrical work that ultra-microscopic spark discharges create an agreeable diversion. In practice the smallest appreciable air-gap across which a spark will jump, at ordinary temperatures and pressures, is under a direct-current pressure of about 800 volts, and the length of the gap is less than a thousandth of an inch. As the experiment is ordinarily tried, with a spark-gap having opposed needle points, one of which is screw-advanced, a pressure of 250 volts fails to produce a spark discharge unless the points are first brought into contact. Nevertheless, it is manifest that this inability to detect a spark distance for pressures of 500 volts or less is attributable to the mechanical imperfections of the spark-gap; since it is well known that the coherer will operate at a few volts pressure under conditions where the gaps between the opposed electrodes are of microscopic length. A recent article in the *Philosophical Magazine* by Prof. Carl Kinsley, on the subject of short spark discharges, relates some remarkable experimental results. The spark-gap used was a solid affair, in which the electrodes were not needles, but relatively large polished surfaces of platinum-iridium alloy presenting a slight relative curvature of the knob-and-plate type. The plate was held fast, and the knob advanced toward it by a screw, itself driven by a worm. In this manner very minute distances between the electrodes could be established. These distances were measured optically. The microscopist's unit of length is a micron or millionth of a meter—about the 1/25,000th of an inch—indicated by the Greek letter mu (μ). The thousandth of this length, or billionth of a meter, is commonly represented by a double mu ($\mu\mu$). It may be called a bicron, and in inch measure is about the twenty-fifth part of one-millionth of an inch. Some of the spark-gaps recorded in the paper descend to a few bicrons, the lowest measured being, in fact, 3 bicrons. The sparking pressure in this case is stated to have been about 1 volt, while in one case a pressure of 0.2 volt seemed to produce a still smaller spark about 0.2 in length.

As may readily be imagined, special precautions had to be taken to exclude dust from the air-gap, and to maintain the temperature nearly steady. On different days the results obtained differed considerably; but on any one day's observations the sparking voltage was found to be proportional to the gap length. The range in variation was from 1.2 bicron to 8 bicrons per volt. That is to say, in some of the observations the sparking distance per volt measured 1.2 bicron, while at other times it was much longer, and was observed in one series as long as 8 bicrons per volt. The cause for this large variation is not apparent from the paper. A wide field for experimental research seems to be opened up through the portals of these observations. It is stated that the sparking distance per volt increased with time. In one case the distance per volt was 1.2 bicron 5 hours after closing the spark chamber from the surrounding air; 22 hours after closing, the distance per volt had increased to 1.4 bicron. The sparking distance per volt is stated to have been always reduced by washing the electrode surfaces in alcohol before buffing them on a soft cotton wheel.

Some interesting observations are also appended on the phenomena of coherence presented in the apparatus. When two clean contact surfaces are pressed together their contact resistance is quite small or about 1/10 ohm. If the two electrodes are slowly separated, the resistance will rapidly increase before the continuity is destroyed, after the movement has reached, say, 30 bicrons. This is, of course, a matter of elasticity. It is to be supposed that two perfectly rigid bodies devoid of pliability would break electric continuity within a separating movement of, say, 1 bicron. If now after discontinuity has occurred and the separation is continued to a distance of, say, 100 $\mu\mu$, a spark discharge is passed between the electrodes, the surfaces will cohere, and the resistance will again become very small. The surfaces now appear to be welded together, for they can be drawn apart for nearly 700 $\mu\mu$ more before producing continuity. At the same time the resistance increases steadily from a fraction of one ohm to 115 ohms just before rupture. It is shown that when the separation is about half of the final separation of rupture, the resistance of the coherence is 2 ohms and the mean diameter of the platinum-iridium wire of this length and resistance would be 440 bicrons. The wire, if of uniform diameter throughout, would be about as broad as it is long at this stage of the separation. Beyond this stage the mean diameter of the coherence must dwindle very rapidly to account for the resistance observed.

It is an inference from these observations that when platinum-iridium surfaces are separated by about 100 bicrons, the application of a few volts will make them cohere and bridge the gap permanently. After coherence has taken place, the surfaces are locally welded together. When the surfaces are drawn apart, a wire of the metal is drawn between them for a distance about seven times as great as that across which the coherence took place. The wire is equivalent to a double cone of rapidly diminishing diameter at the neck.

It has been suggested by Lodge that coherence is an electrostatic phenomenon, and that when the two opposing electrodes are very close together, the electrostatic attraction breaks down the barrier. If we bring two plane metallic surfaces opposite to each other at a distance of 100 bicrons apart and bring 20 volts pressure to bear upon them, the gradient will be two millions of volts per centimeter. This will determine an electrostatic stress of about 1½ atmospheres toward each other, and this would seem to be capable of extending them into actual contact. In fact, it would be much more wonderful if coherence did not take place under such conditions than that it does take place. Once the electrostatic weld has been produced, a very small force would be sufficient to break it. For example, if the weld were circular and had a diameter of 500 bicrons, then with a tensile strength of iron wire in the weld, rupture would occur at a force of a few milligrams weight. It seems also likely that the strength of such electrostatic surface welds as occur in coherence may be much less than the strength of the solid metal. It would be very interesting to determine experimentally whether the sparking distance between metallic electrodes very nearly in contact is altered by replacing the air-gap by an oil gap. According to the electrostatic theory, the tension corresponding to a given electric gradient would be greater in oil than in air, if thin films of each behave like thick layers. In the paper referred to no large difference was observed when illuminating gas was substituted for air. One thing seems clear from the results. This is that the electric intensity required to puncture thin films of air is much greater than that required to puncture thick layers. Thus air in bulk is known to break down at an intensity of 40,000 volts per centimeter. In the thin films described in the paper the air withstood from 1,250,000 volts per centimeter to 8,300,000 volts per centimeter. These thin enveloping layers of air must have wonderful properties.

Meeting of Association of Railway Telegraph Superintendents.

The annual meeting last week at Chattanooga, Tenn., of the Association of Railway Telegraph Superintendents was largely attended, about one-third of the enrolled members being present. The convention was opened Wednesday, May 17, at 10 a.m. by an address from the mayor of Chattanooga. The first paper presented was entitled "The Railway Telephone Service; Cost of Line Construction," the author being Mr. Frank F. Fowle, special agent of the railway department of the American Telephone & Telegraph Company. The author pointed out that the cost of line construction naturally varies widely, owing to fluctuations in price of material and cost of labor. In the case of bare wire lines the cost of construction may be computed on the basis of 15 cents per pound for copper and 3½ cents for iron on the assumption that pin space is available on existing pole lines. As to cables, the rubber cable requires more than three times as much copper as the paper cable owing to the greater electrostatic capacity, and the rubber insulation is more expensive than paper. The main subject of the paper is developed under the heads of simultaneous use of circuits for telephony and telegraphy; circuits wholly of cable; lay-out and design of circuits; use of existing wire facilities; circuit efficiency in handling traffic; records of traffic and wire trouble; crossing of high-tension power transmissions; existing railroad telephone systems. Data are given for calculating the cost of copper and iron wire telephone circuits, of circuits wholly in cable and circuits for simultaneous use for telephony and telegraphy. In the discussion which followed it was stated that iron wire of Swedish manufacture has been up 45 years, but that it is now impossible to get wire of this grade. Copper does not deteriorate except in the vicinity of chemical plants; very little copper has been up over twenty years. The life of iron wire is extremely variable, dependent upon the exposure to smoke from locomotives; the life may be only five or six years, while on the other hand it may be 25 years. No pure iron is now furnished, all so-called iron wire being of low-grade steel.

On Wednesday afternoon a very enjoyable trip was taken up Lookout Mountain. On Thursday morning it was decided by vote to hold the next meeting at Denver, Colo., June 20, 1906. The first topic taken up was a discussion on the laws of Kansas and Michigan relative to wires crossing railroad rights of way. A committee was appointed to appear before the American Railway Association on this subject in the interest of legislation to regulate crossings. Of this committee Mr. E. P. Griffith was named chairman, the other members being Mr. L. B. Foley and Mr. C. P. Adams.

A paper by Mr. William Maver, Jr., entitled "Some Notes on Breaks Due to Sleet and Wind Storms and Some Proposed Remedies," was then read. In the discussion it was recommended to double the number of poles per mile, reduce the height of line and insulate the guys in order not to impair the insulation. A committee was appointed to gather data on this subject, Mr. Maver being named chairman. Mr. C. Selden, chairman of the Committee on the Use of the Telephone for Train Orders, reported that the B. & O. Railroad is using telephones for train dispatching at non-telegraph stations and ends of long sidings, the telephone circuit being to the nearest telegraph train order office. No telegraph circuits, however, have been dispensed with and no operators have been displaced. The orders are spelled out letter by letter and repeated in the same manner, the telegraph operator acting as an intermediary between the dispatcher and train conductor. The method expedites the traffic movements and reduces the overtime of train crews, especially on single track with sidings several miles long.

The annual election of officers was then held with the following result: President, Mr. E. E. Torrey; vice-president, Mr. E. A. Chenery; secretary and treasurer, Mr. P. W. Drew. Mr. L. B. Foley, chairman of the Committee on Composite Circuits, called on Mr. F. F. Fowle, who gave some statistics of lines now in service operating telegraphy and telephony simultaneously. Several members gave their experience with railway composite circuits. The only difficulty met with was in adjustment and maintenance of ringing apparatus. Mr. Groce considered that the cost of battery maintenance was very high, being more than the interest on a separate wire for the telephone, and he believed there is no economy except in the case of long circuits. At the afternoon session the paper read by Mr. F. F. Fowle on Wednesday was discussed by Messrs. Selden and Groce. Exception was taken to the assumption that a telephone circuit is equal in traffic capacity to a quadruplex Morse circuit. Mr. Groce said that the telephone brought forth a new class of traffic and that the telegraph wires were not relieved. In the further discussion of high-tension crossings, Mr. Fowle said that the single-phase railway is not destined to extensive use or wide application because of the high cost of car equipment, complexity of the system and its disadvantages with respect to exchange of traffic with existing direct-current systems. Mr. I. N. Miller, superintendent of the Western Union Telegraph Company, at Cincinnati, stated that a telegraph line 35 miles long, parallel to the Rushville, Ind., single-phase railway, is useless for a quadruplex, Wheatstone or ticker service on account of excessive induction. The lines are 300 ft. apart, and the trouble has been located as due to the trolley wire current. The only remedy suggested was the stringing of ground wires in connection with the telephone, the line grounding every half mile. Mr. H. Raynor Wilson, of England, then gave an address on the "British Single-Track Block Systems." On Friday a trip was taken to the National Cemetery, Orchard Knob, Missionary Ridge and Chickamauga Park.

Exhibits of apparatus were made by the Western Telegraphone & Telegraplex Company, of Chicago; the Morse Signal Company, of Milwaukee; the Railroad Supply Company, of Chicago and New York; the Stromberg-Carlson Manufacturing Company, of Chicago, and the Sumter Telephone Manufacturing Company, of Sumter, S. C.

Programme of the Denver Lighting Convention.

Subjoined is the programme of the National Electric Light Association meeting at Denver and Colorado Springs next month:

Tuesday, June 6—First session, 10 a.m., Convention Hall, Brown Palace Hotel. Address of welcome, the Mayor of Denver. President's address, Ernest H. Davis, Williamsport, Pa. (1) Report, Progress, T. Commerford Martin, New York. (2) "The Paramount Importance of Choosing Standard in Preference to Special Machinery," David Hall, Cincinnati, O. (3) "Insulation Testing, Apparatus and Methods," C. E. Skinner, Pittsburg, Pa.

Tuesday, June 6—Second session, 2 p.m. (4) "Automatic Synchronizing of Generators and Rotaries for Lighting and Power Systems," Paul MacGahan, Pittsburg, Pa. (5) "Notes on Rotary Converters and Motor-Generators for Lighting and Power Systems," Louis E. Bogen, Cincinnati, O. (6) "The Organization of Working Forces in Large Power Houses," W. P. Hancock, Boston, Mass. (7) Report, Committee on Steam Turbines," W. C. L. Eglin, chairman, Philadelphia. (8) "Operating Features of the Curtis Steam Turbine," A. H. Kruesi, Schenectady, N. Y.

Wednesday, June 7—Third session, 10 a.m. (9) "Series Alternating-Current Motors for Industrial Work," Clarence Renshaw, Pittsburg, Pa. (10) "A New Type of Single-Phase Motors for Elevator Work," S. Percy Cole, St. Louis, Mo. (11) "Long-Distance, High-Tension Transmission in California," John A. Britton, San Francisco, Cal. (12) Report, "Present Methods of Protection from Lightning and Other Static Disturbances," Alex. Dow, Detroit, Mich. (13) "The Nernst Lamp; Its Present Performance and Commercial Status," E. R. Roberts, Pittsburg, Pa. (14) "The Choice of an Insulated Cable," Wallace S. Clark, Schenectady, N. Y.

Wednesday, June 7—Fourth session, 8 p.m. (15) "Some Investigations of Induction Losses," E. P. Dillon, Colorado Springs, Colo. (16) "Mercury Arc Rectifiers," P. D. Wagoner, Schenectady, N. Y. (17) Report, "Advertising Methods," Percy Ingalls, Newark, N. J. (18) Report, "Sign and Decorative Lighting," La Rue Vredenburgh, Boston, Mass. (19) "Free Signs and Flat Rates," C. W. Lee, Newark, N. J.

Thursday, June 8—Fifth session, 10 a.m. (20) Report, "Progress of Electric Heating," James I. Ayer, Boston, Mass. (21) Report, "Purchased Electric Power in Factories," E. W. Lloyd, Chicago, Ill. (22) Report, Committee on District Steam Heating, W. H. Blood, Jr., chairman, Seattle, Wash. (23) "Wrinkles," H. C. Abell, editor, New York City.

Thursday, June 8—Sixth session, 2 p.m. (24) Report, Committee on Relations with Kindred Organizations, James I. Ayer, chairman, Boston, Mass. Executive session. (25) Report, Committee on Rates and Costs, Charles L. Edgar, chairman, Boston, Mass. (26) Report, "Municipal Ownership," Arthur Williams, New York, N. Y. (27) "Question Box," Homer E. Niesz, editor, Chicago, Ill.

Thursday, June 8—Seventh session, 8 p.m. Executive session. Report of secretary and treasurer. Report of Executive Committee. Report of Committee on Relations between Manufacturers and Central Station Companies, Henry L. Doherty, chairman, Denver, Colo. Report of Committee on Standard Rules for Electrical Construction and Operation, Charles L. Edgar, chairman. Election of officers. During the convention, Dr. Louis Bell will present a report on the tantalum lamp.

The entertainment of delegates will include a theatre party at the Elitch Summer Gardens, a luncheon at the Denver Country Club for the ladies, followed by a drive about the city. The ladies will also be entertained at the Orpheum Theatre during an evening session of the convention and after this session the men will be entertained at a smoker. During the week there will be golf matches at Colorado Springs, with one prize for men and one for ladies.

One afternoon will be devoted to a broncho-busting contest. Great care has been taken in selecting for this typical Western exhibition the best horses and men to be found in Wyoming, Colorado and Mexico.

On Friday morning the entire party will be taken to Colorado Springs on special trains. During Friday afternoon there will be drives to points of interest about Colorado Springs, Glen Eyrie, Garden of the Gods, Cheyenne Canons, over the Bear Creek Canon road to Bruin's Inn; also visits to the power plants of the Colorado Springs Interurban Railway Company, the Colorado Springs Electric Company, the Curtis Company's lignite coal mines, the reduction mills at Colorado City, the Pike's Peak Hydro-Electric Company's hydraulic plant at Manitou, from which point the delegates may take the "Cog Road" to Pike's Peak. In the evening there will be a concert at the Broadmoor Casino.

Saturday will be given to an all-day trip to Cripple Creek, through the most beautiful scenery in Colorado. On Sunday such of the delegates as desire to do so will have an opportunity to take trips mentioned for Friday afternoon, as it will be impossible for all these trips to be taken in one day.

The headquarters of the association will be at Brown Palace Hotel. This hotel will not accommodate all the delegates, but there are a number of other first-class hotels in the immediate vicinity, where the hotel committee will place those making application too late for rooms at the Brown. Reservations should be made through Mr. Frank Farrar, committee's secretary, 405 Seventeenth Street, Denver.

Municipal Ownership and Corporate Control.

At the tenth annual meeting of the National Association of Manufacturers held at Atlanta, Ga., last week, Mr. Ludwig Nissen, of New York, addressed the association on governmental relation of public franchises. The address was largely devoted to a discussion of the un-Americanism of government ownership of public utilities. He said: "The present trend of public opinion in the effort to check the evils of control by monopoly is towards the other extreme, municipal or State ownership. The realization of that principle would mean State socialism. Nothing could be more foreign to the spirit in which the establishment of our government was conceived. It is absolutely un-American because it is undemocratic. The gross injustice of the public service corporations is unquestionably the cause for the now general demand of the unthinking public for a system of municipal or State ownership of all public utilities. This system, if long enough continued, must and will inevitably lead, first, to municipal, then to State, and finally to national ownership of public utilities. * * * As a remedy for these conditions, I would offer the following hints for your careful consideration:

"(1) All public service corporations should be under strict surveillance of the authority that creates them. They should not be allowed to issue obligations for more than the capital actually paid in.

"(2) Whenever a charter or franchise is granted to a public service corporation, it should be granted only on condition that service rendered by such coryoration shall be adequate to the public needs. Such charter or franchise should be forfeited to the authority that grants it, unless the conditions of service shall be strictly adhered to. Such charter or franchises should not be allowed to be given away, sold, leased, or merged with that of any other corporation, except under terms carefully specified by law."

Programme for the Institute Meeting.

Subjoined is the preliminary programme for the meeting of the American Institute of Electrical Engineers at Asheville, N. C., June 19-23:

(1) "Appalachian Water Powers," by F. A. C. Perrine. (2) "Three-Phase Traction," by F. N. Waterman, member. (3) "Limits of Injurious Sparking in Direct-Current Commutation," by Thorburn Reid, member. (4) "A Study in the Design of Induction Motors," by C. A. Adams, assistant professor of electrical engineering, Harvard University, Cambridge, Mass. (5) "Choice of Motors in Steam and Electric Practice," by Wm. McClellan, University of Pennsylvania, Philadelphia, Pa. (6) "High-Potential Oscillations of High Power in Large Power Distribution Systems," by Charles P. Steinmetz. (7) "The Constant-Current Mercury Arc Rectifier," by Chas. P. Steinmetz. (8) "Heavy Electric Freight Traction," by C. de Muralt. (9) "A New Instrument for Measuring Alternating Currents," by E. F. Northrup. (10) "Motor-Generators and Synchronous Converters," by W. L. Waters. (11) "Limitations in Direct-Current Machine Design," by Sebastian Senstius. (12) "Electrical Features of Block Signaling," by L. H. Thullen. (13) "The Development of the Ontario Power Company," by P. N. Nunn. (14) "The Standardization of Fuses," by H. O. Lacount. (15) "A New Induction Generator," by William Stanley. (16) "An Experimental Study on Commercial Transmission Lines of the Rise of Potential Due to Static Disturbances, Such as Switches, Grounding, Etc.," by Percy H. Thomas.

Papers have also been promised by M. H. Gerry, Jr., John W. Howell, Dugald Jackson, S. M. Kintner, H. W. Fisher and C. E. Waddell.

Arrangements have already been made with the Southeastern Passenger Association, in whose territory Asheville is located, for a one and one-third round trip fare on the certificate plan. It is probable that the Southern Railway Company will allow the members of the Institute a one-fare rate over their lines. As it will undoubtedly be convenient for most of the members in the New England and Middle States to meet in Washington, a special train will be run from Washington Sunday night, June 18, provided there are 85 (or more) passengers.

The convention headquarters will be at the Battery Park Hotel, where there is a suitable hall for the reading of papers. The hotel accommodations are excellent. The rates at this hotel will be from $3.50 to $4.50 per day, on the American plan. Cheaper accommodations may be had at other hotels.

The local committee, through Mr. C. E. Waddell, is preparing a programme for the entertainment of members, and efforts are being made to make the convention attractive and pleasant. Delegates to the convention will have the privileges of the Asheville golf links, one of the most picturesque links in the country, and also of the Battery Park Hotel tennis courts.

Rural Electric Railways.

With the title "Light Electric Railways" Mr. J. R. Cravath read a paper, May 28, at the Chicago Branch of the American Institute of Electrical Engineers, which presented in considerable detail a plan whereby electric traction could be extended to rural districts which, owing to the light amount of traffic available, cannot now be served. He pointed out that the typical interurban electric railways of the Central Western States cost from $20,000 to $25,000 per mile of single track and require for financial success a gross revenue of $3,000 to $4,000 per track mile per year. As a result of this situation such roads can only be built through the most desirable territory, and only a small fraction of rural communities can benefit from electric traction.

Mr. Cravath in his paper sketched the outlines of a narrow-gauge railway system and gave estimates in detail of the cost per mile of such a line. The light electric rural and interurban railway proposed would have a narrow-gauge track, the gauge being 28 inches, and use 30-pound standard T rails. Each car would have a truck at each end. The portion of the car between the trucks would overhang, the space at each end above the latter being utilized for the installation of the various electrical devices that are now placed under the car, but which could not be so placed when the car body is hung as low as proposed. These compartments could also be

occupied by the motormen and used for baggage. A car of this kind 18 ft. long would seat comfortably 12 passengers, and equipped with a motor truck at both ends would not weigh more than 12 tons. The maximum speed would be 15 or 20 miles per hour. Single-phase traction is suggested with overhead trolley construction. With a voltage of 3,000 to 4,000, feeders would not be needed to supplement the trolley wire on a rural road 20 miles long with power supplied at one end. Owing to the reduction of the cross-section of cuts and fills, due to the narrow-gauge, such a road could pick a location around hills and on account of the lower speed could use smaller curves than in the case of the ordinary high-speed interurban railway. By laying the road out so as to avoid heavy grading, the expense of bridges and trestles would also be reduced to a minimum. Ballast might also be dispensed with.

An estimate in detail is given of the cost per mile of such a line and its equipment on the basis of a 15-mile road. Not including any expenditure for right of way, the total for the track is $4,335 per mile; for general roadway items, $300 per mile; overhead line, $889 per mile; rolling stock, buildings, etc., $2,313 per mile, the grand total being $7,837 per mile of track. This provides for three passenger motor cars, two passenger trailers, one freight motor car and 15 miscellaneous freight car trailers. An estimate of the ordinary operating expenses per train mile of such a road is 8½ cents per train mile and for a traffic of 135,000 train miles per year, including interest on cost of construction, the total annual charge would be $1,239 per track mile.

The paper gives an interesting analysis of rural passenger and freight traffic, upon which is based an estimate of the traffic possibilities of a strictly rural territory. Estimates were obtained from owners of six ordinary farms located in Central Iowa as to the amount of farm products shipped and supplies received. Upon these data it is estimated that the total freight revenue from an average rural district in Iowa, Illinois or Indiana is $81 per square mile. After discussing in detail the question of passenger traffic, the conclusion is finally arrived at that a total gross earning of $1,633 per track mile is possible; subtracting the charges previously estimated, this would leave a surplus of $394 per track mile.

California Independent Telephone Association.

Representatives of the various home telephone companies in California met in Los Angeles on May 3 and organized the California Independent Telephone Association. The purpose is to bring about closer relations between the independent companies operating in the State. Meetings will be held the second Tuesdays of each month, when matters pertaining to the betterment of the service will be discussed.

The following officers were elected: John Van Liew, Los Angeles, president; D. S. Parker, Pomona, first vice-president; Roscoe Howard, San Diego, second vice-president; P. T. Spencer, Whittier, secretary. The Executive Committee comprises K. C. Wells, Redlands; W. J. Lambert, Riverside; A. L. Orton, Pasadena; P. M. Kerr Higgins, Los Angeles.

The progress made by the independent telephone movement in Southern California was illustrated by the report that more than $10,000,000 had been invested in telephone plants of various independent companies which now are operating thirty exchanges with more than 30,000 telephones and toll line circuits, reaching 110 towns in Southern California, all this having been accompiished within the last two years.

Train Lighting and Heating.

One of the topics discussed at the recent International Railway Congress was train lighting. The discussion was interesting, although it cannot be said to have brought out any new features or data. The section adopted the following conclusions:

"As regards lighting, the congress notes the development of the use of incandescent mantles, heated by oil gas and sometimes by common gas, and of different systems of electric lighting. Cylindrical mantles seem to be somewhat stronger than globe mantles, but the latter distribute the light somewhat better. Various types of mantles are used in Europe by different managements, especially in France and Germany, and are beginning to extend to the United States.

"Systems of electric lighting are giving satisfaction on different roads. Attention is called to their advantage in certain cases for intermittent lighting, in passing through tunnels and operating driving fans.

"Acetylene gas has been used mixed with Pintsch gas, especially in France and Germany, but a tendency is observed to abandon this mixture, owing to the use of mantles. On the other hand, mention is made of the use in America of pure compressed acetylene, with some special precautions.

"Steam heating has a tendency to extend in different countries. To obtain sufficient heat for very long trains, or in cases of very low temperature, care is taken either to use pipes of sufficient diameter or compressed air mixed with steam.

"The adoption of a uniform coupling for all the cars in the same territory is an important question to be solved.

"The congress notes the different systems of car ventilation that have been applied, especially that in use on the Pennsylvania Railroad."

Absorbing Independent Telephones.

The following important announcement has been made by President L. G. Richardson, of the Central Union Telephone Company: "The arrangement entered into between the Central Union and United Telephone Companies is one of the most important which has taken place in telephone circles in many years. The Central Union will lease the Bell instruments to the United Company, and as our company has no connections in the field occupied by the United Company, this arrangement practically gives us a new telephone field. The United Telephone Company has $480,000 bonds and $300,000 stock outstanding, and its property is worth about $700,000. This company owns the exchanges and toll lines in Wells, Grant, Blackford and Huntington Counties in Indiana, and has 5,000 subscribers. Under the new working agreement, the United Company secures connection with the toll lines of the Central Union Telephone Company and those of the American Telephone & Telegraph Company. The United Company heretofore has been operated in connection with the independent telephone companies in Indiana, but will now sever its affiliation with the independents and will be operated in connection with the Bell companies. The president of the United Company is Hugh Dougherty, president of the Marion Trust Company, Indianapolis." Mr. Dougherty has been a prominent leader among the independents, holding office in the various associations.

Manufacture of Electroplated Laces.

An interesting description is forwarded to the United States Department of Commerce and Labor by Consul-General Richard Guenther, of Frankfort, Germany, on the manufacture of electroplated laces in Europe. The old galvano-plastic art is employed. One of the first uses of the galvanic current was to coat certain articles with metallic substances, and gilding, silver and nickel plating, bronzing, etc., continue to be done in that way. It cannot, however, be employed on articles that are non-conductors of electricity. Experiments were tried long ago to make such non-conductive articles susceptible to the galvano-plastic process, either dry or wet, by sprinkling them with a very fine powder of metal or graphite, or by immersing them in a solution of metallic salts. In this manner many articles, such as flowers, leaves, fruits and branches, and even delicate articles, were metallized.

A chemist of Brussels devoted his attention especially to metallizing embroideries, and created wonderful effects. Until quite recently they could not be made of practical value, and only now a beginning has been made by an invention, the details of which are kept a secret. A stock company has been formed for its exploitation. Laces are mainly treated. In a few minutes they are made conductors of the electric current and placed in a galvanic bath. Under the influence of a current at about 3 volts, they become coated with an exceedingly delicate metal surface, the colors of which and other properties can be regulated *ad libitum*. The coating is so fine that not the slightest irregularity can be noticed, and the laces remain perfectly soft and flexible. It makes no difference whether gold, silver, copper, bronze or other metals are employed.

The assertion is made that the metallized points, in spite of the thinness of the metal coating, can be united as if soldered together, so that all sorts of combinations are possible. These metallic goods are used for table ornaments, decorating furniture coverings, wainscoting in parlors and for incrustation of fine woods, and the metallized laces can even be polished.

Discussing Municipal Ownership.

A discussion of municipal ownership was held at the National Arts Club, New York City, last week, in connection with a dinner of the Reform Club. Some 300 persons were present. One of the speakers was Judge Herrick, recently Democratic candidate for the Governorship of New York State. He said: "This question of municipal ownership of franchises has come up before in other forms. I remember a mayor who thought that the government ought to control all the bakeries because bread was a public necessity. He also thought the city ought to control all the coal yards because coal was a public necessity. To me it seems as if we ought to control those things which are necessary to protect life and property, and that we ought not to go far beyond that. When you go beyond that in our present stage of development, it seems to me you go to a very great extreme.

"Municipal ownership up to now has proved a great failure with us. We have not been able to manage the few interests we do manage without corruption. You confess every year when the Legislature meets that you were unfit to do many public things.

"And then who is going to manage these great interests for you? The Board of Aldermen? The Legislature has been limiting the powers of the Board of Aldermen from time to time because it has found that they could not do this or that duty properly. Then who? The Mayor? Your Mayor here has governed you very well indeed, but could you tell how he would manage these large enterprises? Could you even tell how he will serve you during the next term?"

A Central Station on the Firing Line.

Readers of the ELECTRICAL WORLD AND ENGINEER are doubtless familiar with the main features of the recent accident on the Pennsylvania Railroad at Harrisburg, where a passenger train collided with a freight, causing the explosion of 50,000 pounds of dynamite, contained in two of the freight cars. The tremendous force of the explosion, which shattered windows three miles from the wreck, inflicted damage on the exterior of the power plant of the Paxtang Electric Company, designed and built by J. G. White & Co., of New York. As a matter of fact, however, the substantial character of the building enabled it to withstand the shock and continue in operation. Mr. Hamblin, who is the general manager of the Paxtang Electric Company, sends a sub-station voltmeter chart on which is indicated the time of the explosion. This shows that no interruption of service was experienced, although 1,000 panes of glass were blown in, covering engines, generators, machinery and floor with finely broken glass.

The explosion occurred only about 150 ft. from the power house and a careful examination failed to locate a crack of any kind either in the stack or in the building, not even a brick of which was displaced. The power station is situated about two miles from the center of Harrisburg, on the bank of the Susquehanna, and contains one 300-kw and four 500-kw, two-phase generators. A transmission line carries the current from the power plant to the sub-station located in the center of the town, from which a portion of the power is distributed by the Edison direct-current system, rotary converters being installed for this purpose. The balance of the power is distributed as two-phase, alternating current.

Congress on Radiology and Ionization.

The Government of the United States has been invited to participate by delegates in the First International Congress for the study of Radiology and Ionization to be held at Liege from the 12th to the 14th of September next, under the patronage of the Belgian Government, the ministers of the interior and public instruction, of agriculture, of industry and labor being honorary presidents thereof.

Members of the teaching corps of the four universities of Belgium and of the military academy are on the committee charged with the organization of the congress. The following is a summary of the programme framed by the committee:

1. Physico-chemical Section (*a*).—Properties of the electrons and accompanying radiations; X-rays, cathodic rays, ionization. (*b*) radioactivity and corresponding transformations; (*c*) meteorological and terrestrial phenomena connected with ionization and radioactivity. (*d*) N-rays.

2. Biological Section.—Physiological properties and medical applications of the various radiations and of radioactivity.

Letters (*a*) and (*b*) include, as particularly interesting points, the examination of terminology relative to the electrons, ions, etc., as well as of the theories concerning the matter and character of the energy.

The Zossen Trials.

Dr. Shulz, president of the Imperial German Railway Department, and chairman of the "Committee on Study," which conducted the celebrated Zossen trials of high-speed electric traction, presented a paper on this subject at the recent Railway Congress in Washington. As the details of these trials have been fully reported in these columns, we merely give below the conclusions of Dr. Shulz on the trials.

As at the introduction of the steam locomotive, danger to the health of travelers was feared from very high speeds before the electric tests were conducted. He stated, however, from his own experience, that the passengers were in no way affected by the speed of 200 km. per hour or more, which was often reached. Each engineer was at his place, occupied in making his observations, and the silence in the car was only interrupted every ten seconds by a bell signal to take readings on the instruments. The duty of the engineer, however, was more arduous, as he had uninterruptedly to observe with the greatest accuracy the run of the car, the line and the signals. Surrounded by apparatus and wires which carried a current at 14,000 volts, those on duty felt perfectly safe; no personal injuries were at any time sustained in spite of the short-circuits which occasionally occurred. It was possible during the run to observe the scenery comfortably, but persons standing on the platforms of the stations passed could hardly be recognized. No injurious effects due to air pressure were felt when trains passed on the neighboring line, and spectators standing near the line had no uncomfortable sensations. More than 300 runs were made, and all without a single accident, and with no damage to property. Remains, however, of small birds that were killed were observed on the front of the car. These birds, doubtless, thought they could avoid the approaching train, but the electric car moved faster than any bird can fly, and they were killed when the car overtook them.

The investigation committee on electric high-speed railways determined under what conditions electric main railways can be operated with high speeds, and it has been proved that such operation is not more dangerous than the present railway practice. A vast field has thus been opened to railway men associated with electrical engineers, and the time may not be far off when a real high-speed electric railway will be an accomplished fact.

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MR. EDWIN B. KATTE.

Edwin Britton Katte was born in St. Louis, Mo., October 16, 1871. His family having moved to New York City in 1877, his education prior to entering college was received there. At an early age he showed a pronounced inclination to mechanical handicraft, and while a boy, the New York School of Industrial Arts awarded to him in an open competition a medal for the creditable design and construction of a working steam launch model. In 1881 he entered the Cutler School of New York City in the lowest class, and eight years later passed the entrance examination for Sibley College, Cornell University. He took there the regular four-year course in mechanical and electrical engineering and upon the acceptance of his thesis, which consisted of a commercial test of one of the first interurban electric railroads, he was graduated in June, 1893, receiv-

ing the degree of Mechanical Engineer. In 1892 he received a Sibley prize for proficiency in mechanical arts.

During the summer of 1893 Mr. Katte traveled through Switzerland and Germany studying electro-hydraulic plants, and considered the advisability of a graduate course in the University of Zurich, but finally decided to return to Cornell University, where during the following year he took special work in the design of vertical marine type engines and in mechanical and electrical testing. Upon the completion of this course in 1894 he received the post-graduate degree of Master of Mechanical Engineering. Having now completed his academic training, he realized the importance of obtaining a knowledge of shop practice and of "workman's ethics" by personal contact with the working mechanic. To that end he sought employment in the establishment of Henry R. Worthington, where he commenced as a day laborer cleaning and chipping castings, later passing to the testing department, and finally becoming a foreman in charge of installation.

In the early part of the year 1896 he became assistant engineer in charge of the erection of the superstructure of the Park Avenue Viaduct of the New York Central & Hudson River Railroad Company. Two years later he accepted a position in the drafting room in the chief engineer's department of the New York Central & Hudson River Railroad Company, whence he was later advanced to the position of assistant engineer in charge of water supply. In 1898 he was appointed mechanical engineer in the engineering department of the New York Central & Hudson River Railroad Company in charge of the design and construction of heat, light and power plants, coaling stations and water supply. His work embraced the preliminary computations and designs of the heat, light and power plant for the remodeled Grand Central Station, New York City, and also the design and installation of an electric lighting and elevator plant for the passenger station at Albany, N. Y.; a gasoline engine electric light plant for the passenger station at Kingston, N. Y.; an electric light and power plant for the Weehawken passenger station; a lighting system for the West Albany shops and a central power station for the same shops of 2,000 hp capacity; and a central power

MR. EDWIN B. KATTE.

station for the Weehawken terminal having a capacity of 2,300 kw in four alternating-current, steam-driven generators. In addition to these works of major importance, his duties as mechanical engineer embraced the design and installation of mechanical and electrical appliances for numerous coaling stations, water supply stations, electric light and power plants for smaller passenger and freight stations, offices, yards, shops, transfer tables, cranes, draw bridges, machinery, etc.

Mr. Katte's most important appointment, and that which he now holds, is electrical engineer and secretary of the Electric Traction Commission of the New York Central & Hudson River Railroad Company, under whose direction he has immediate charge of the electrical and mechanical engineering corps engaged upon the work of electrification of the various lines of that company in New York City and vicinity, this great undertaking including two central power stations, eight sub-stations and the electric locomotives, car equipment and the third-rail and transmission systems for the same.

Mr. Katte is a member of the American Society of Mechanical Engineers and the American Institute of Electrical Engineers.

CURRENT NEWS AND NOTES.

HISTORIC BUILDING BURNED.—Part of the old Speedwell iron works, near Morristown, N. J., in which Prof. S. F. B. Morse and Stephen Vail perfected their first telegraph instrument, was destroyed by fire May 22. The building had been unoccupied since 1870, when the factory was closed. The Speedwell works were erected in 1800. The boiler of the first steamship which crossed the Atlantic Ocean, the *Savannah*, was built at the works in 1819.

MALTA TRAMWAYS.—A system of electric tramways was recently inaugurated at Malta, with 10 miles of track in use, and soon nearly double that mileage will be worked. The rails came from Pittsburg, Pa., and the motors in use were made at the Westinghouse works in England. The cars, which are of the "double-decker" pattern, were manufactured at Manchester, England. There are two sets of engines of 365 hp each. M. D. Jeffs, of New York, is general traffic manager.

A NOTABLE BIRTHDAY.—The ninety-sixth birthday of Mr. Charles H. Haswell, first chief engineer of the United States Navy Department, 1836-1851, author of the famous "Pocket-Book," and consulting engineer for the City of New York, was celebrated by a party of friends at the Engineers' Club, New York City, on May 22. The guest of the evening was in excellent health and spirits, and spoke two or three times. During the evening the club acted favorably upon an amendment to the constitution creating a class of five honorary members, and the board of trustees promptly elected Mr. Haswell as one of the five.

ONE OF THE N. E. L. A. TRIPS.—Among the numerous trips and entertainments which the electric light men of Colorado are planning for the visitors to the National Electric Light Convention, the most important is the trip from Colorado Springs to Cripple Creek over the new short line railroad. This trip, which will occupy almost an entire day, will afford a chance to see some of the finest mountain scenery and mountain railroad engineering to be found in Colorado. Every mountain railroad trip in Colorado has its peculiar features which make it different from the others, and the ride from Colorado Springs to Cripple Creek will be a novelty in the character of its scenery even to those who have been over many other mountain railroads in that State. The views of Colorado Springs, the plains and Cripple Creek which are afforded from the high points on the mountain range reached by the railroad can be duplicated nowhere.

STATE INDEPENDENT TELEPHONY.—The annual convention of the New York State Independent Telephone Association will be held at the Common Council Chamber, City Hall, Albany, N. Y., June 16. A good programme has been prepared and from present indications the attendance will be large. The officers of the association are as follows: H. M. Persons, president, Buffalo, N. Y.; Howard Hendrickson, vice-president, Albany, N. Y.; Boyd McDowell, second vice-president, Elmira, N. Y.; T. Harvey Ferris, treasurer, Utica, N. Y.; T. S. Lane, secretary, Buffalo, N. Y. The members of the Executive Committee are H. H. Persons, Geo. R. Fuller, B. G. Hubbell, Edward Davis, S. B. Rawson, J. S. Brailey, Jr., C. H. Poole, T. B. Basselin, F. M. Potter, Jr., J. F. Stockwell, Some very effective work has been done, throughout the State, during the past year by the organization of district associations which form a part of the State association. The following districts have been organized: Buffalo, H. H. Persons, Buffalo, N. Y., chairman; T. S. Lane, Buffalo, N. Y., secretary; Rochester, George R. Fuller, Rochester, N. Y., chairman; F.S. Bronson, Geneva, N. Y., secretary; Hornellsville, H. M. Bennet, Hornellsville, N. Y., chairman; C. M. Kelly, Hornellsville, N. Y., secretary; Binghamton, J. B. Marquis, Jr., Norwich, N. Y., chairman; M. L. Sternberg, Lisle, N. Y., secretary; Albany and Troy, W. L. Burke, Troy, N. Y., chairman; S. M. Strong, Schenectady, N. Y., secretary; Jamestown, W. H. Homewood, Jamestown, N. Y., chairman; John H. Wright, Jamestown, N. Y., chairman; Syracuse, F. M. Potter, Jr., Syracuse, N. Y., chairman; H. W. Fluhrer, Auburn, N. Y., secretary. Further information relative to the convention can be secured by addressing T. S. Lane, 332 Ellicott street, Buffalo, N. Y.

TELEPHONE SERVICE FOR CUBA.—The Cuban Congress has, according to a dispatch from Havana, passed a bill empowering President Palma to grant at public letting a concession for a long-distance telephone service. A guarantee of $50,000 will be required.

RADIOACTIVE TESTS.—The Colorado School of Mines, Golden, Colo., will examine free of charge until March 1, 1906, all specimens of minerals and natural waters for radioactive properties sent there to Prof. E. R. Wolcott. The analyses will not be made until the opening of the college year on September 5.

X-RAY EXPERT.—The New York Municipal Civil Service Commission will hold an examination on June 5 for the position of electrician (X-ray expert) in the Department of Charities, at a salary of from $750 to $1,050 a year, and on June 7 for the position of assistant engineer, rapid transit, at a salary of $1,200 a year.

LONDON TUBES AND LIGHTS.—A cable dispatch from London says: "A committee of the House of Commons has commenced the consideration of a bill providing for the installation in London of electric light and pneumatic tube systems similar to those in use in America. Mr. J. Pierpont Morgan is among the promoters of the company, which has a capital of $20,000,000. Ninety-five miles of double tubing and 172 stations are proposed." Col. R. E. B. Crompton, the well-known English electrical engineer, is interested in this project.

WESTERN SOCIETY OF ENGINEERS.—The first ladies' night of the electrical section of the Western Society of Engineers was celebrated May 12, at the Society's rooms in the Monadnock Building, Chicago. Dr. Albert B. Hale gave a popular lecture on "The Isthmus of Panama," illustrated by over 100 lantern slides. Members of the society with ladies, to the number of over 170, crowded the room to its utmost capacity. After the lecture, light refreshments were served in the corridor next to the society's quarters. It was a very pleasant occasion.

LONG ISLAND MOTOR CAR TESTED.—In a test of an electric motor car on the Long Island Railroad May 18, a speed of 45 miles an hour was maintained over a four-mile trial course on the long trestle over Jamaica Bay. The motor car was of the type to be used on the road. It has been tested with trains of all lengths and weights, and found to be satisfactory in every respect. The third-rail system was used. It is expected to have the electric service ready on the Rockaway Beach division by June 1.

MARRIED BY TELEPHONE.—A Williamsport, Pa., dispatch dated May 19, says: "The Rev. H. E. Harman married John Carothers and Miss Mary Ludiken, of Berwick, to-day over the telephone at a distance of fifty miles. Mr. Harman was attending the synod and was unable to get home to perform the ceremony. With the guests assembled, the telephone was used rather than postpone the wedding or call another minister. The regular service of the Lutheran Church was used, the questions and answers being given over the wire, with the exchange operator as witness."

THE NEW HAVEN RAILROAD.—The directors of the New York, New Haven & Hartford Railroad have authorized the president to arrange to establish electric motive power for its trains in running into the Grand Central depot, New York. The directors have been looking forward to this step for some time, since the New York Central decided to make this change for its trains. The new arrangement will require not only the purchase of electric locomotives and the establishment of a power house, but there will be necessary a big round house for the steam locomotives, where they can be housed so as to play their part in the new system.

NEW YORK PUBLIC LIGHTING.—Mayor McClellan in signing the bill passed by the Legislature empowering the city to use new water supply sources for generating electric current for public lighting wrote in a memorandum: "This bill is in effect a substitute for the provision originally contained in the water supply act, which in spite of the protest of the Mayor and numerous civic bodies was stricken from that bill. This is another proof that earnest protest against injustice is not always unavailing. If both this bill and the water supply bill become law, the city will, I am advised, be able to secure large quantities of electricity, the cost of producing which will involve but a slight additional expense, both in the work of construction and maintenance, over that required for the water supply system itself, and the city will thereby be able not only to light many streets and public buildings, but to save large sums of money annually on that account."

WIRELESS BETWEEN NEW YORK AND CUBA.—It is announced in the daily papers of May 23 that the first wireless message between Havana and New York was received at the offices of the Atlantic De Forest Wireless Company, at 42 Broadway, May 22. It came all the way by wireless with several relays, taking in the steamship *Concho,* bound north, between Key West and Hatteras. The message was transmitted from Havana to Key West, thence to the *Concho,* to Hatteras, to Atlantic City, and finally to 42 Broadway. The company announces that when the stations at Charleston and Savannah are finished they expect to communicate between New York and Havana both ways.

GOVERNMENT TELEPHONE APPARATUS.—Gen. A. W. Greely, chief signal officer U. S. Army, announces that on June 1, or as soon thereafter as possible, advertisement for proposals for furnishing the Signal Corps of the army with telephone apparatus to the value of approximately $75,000 will be issued. Models of practically all of this equipment may be seen in the Signal Corps Model Room, Washington, D. C., and drawings and specifications are under preparation. This advance information is furnished to enable manufacturers to send a representative to Washington to inspect the models, as it is believed such a visit will enable the manufacturers to bid more intelligently than otherwise. Representatives should call upon Major Edgar Russel, officer in charge Electrical Division, Lemon Building, Washington, for permission to inspect the models.

PHOTOGRAPHING THE SUBWAY.—At the annual meeting of the American Institute of Electrical Engineers this year some interesting biograph pictures were shown of the viaduct portion of the New York Subway. On Sunday last further work in this direction was done by the American Mutoscope & Biograph Company, on the full underground section between Fourteenth and Forty-second Streets, when 6,300 separate film pictures were taken in seven minutes by means of Cooper Hewitt mercury arc lamps, giving a total of 54,000 cp. The photographic car carried a complete electric installation, including voltmeters, ammeters, a dynamo and a 110-volt generator belted to a 555-volt motor, fed from the third rail. The electrical apparatus took up the rear end of the car. The Cooper Hewitt tubes were strung at the front in a long line. Each tube was half incased in a brilliant reflector, so hung that the piercing green rays were thrown to the right or local track a bit ahead. Local and express trains were taken and passengers were shown in movement at the stations.

UNIFORMLY DISTRIBUTED INDUCTANCE IN TELEPHONE CIRCUITS.—When inductance coils are introduced at regular intervals through a telephone cable, the electrostatic capacity is neutralized by sections, but the conductors of sections between the inductance coils are free of any characteristic tending

to counteract the electrostatic condition that may arise between the inductance coils. Prof. D. C. Jackson, according to a patent issued May 16, proposes to form the conductor which is to carry the current in a helix to create inductance, this helical formation being practically continuous throughout the entire circuit. The core for the helix may be of air, or magnetic material may be used for this purpose. The accompanying cut illustrates a grounded telephone circuit, the major portion of its metallic part being in the form of an inductance helix. On the assumption that the highest voice harmonic which must be preserved for satisfactory telephonic transmission has a frequency of 1,000 periods per second, the inventor develops formulas for determining the amount of inductance necessary to neutralize any given amount of electrostatic capacity.

CADIZ-TANGIER SUBMARINE CABLE.—The French cable connecting Cadiz, Spain, with Tangier, provided for by the Franco-Spanish Convention, has been completed. The cable belongs to the French Government.

LARGE TRANSFORMER FOR PURDUE.—A 1,000,000-volt transformer has been installed in Purdue University under the supervision of Prof. J. Walter Esterline. It has been erected in a building at the edge of the campus.

A. S. M. E. MEETING.—The American Society of Mechanical Engineers will hold its fifty-first meeting at Scranton, Pa., from June 6 to 9, when an interesting programme will be presented, inclusive of several papers by well-known men. Some of these papers deal with the steam turbine, but otherwise none of them touch very closely upon electrical ground.

STREET RAILWAY CONVENTION.—At a meeting of the executive committee of the Street Railway Association of the State of New York, just held, it was decided to hold the annual convention this year on June 27 and 28 at Lake George. The headquarters will be at the Fort William Henry Hotel. Messrs. A. B. Colvin and E. F. Peck were appointed the committee on entertainment.

NEW EAST RIVER TUNNEL.—On April 18 the Rapid Transit Commission laid out a new tunnel under the East River, between Thirty-fourth Street, New York, and Long Island City. This route was determined upon after deciding to reject the Thirty-fourth Street moving platform scheme. It is stated that the request and bid for this new route came from Metropolitan Street Railway interests, the moving platform idea representing the Interborough interests.

RADIUM THREE MILLIONS AN OUNCE.—A London dispatch states that the price of radium has advanced owing to the difficulty of obtaining further supplies. Research work involving its use, the dispatch adds, is almost at a standstill in consequence. Sir William Ramsay states that £20 a milligram, or a rate of $3,000,000 an ounce, is now demanded. An expert expresses the opinion that not more than half an ounce of radium has been manufactured since Prof. Curie discovered it.

BOSTON-DENVER.—Mr. C. H. Hodskinson, acting master of transportation for New England for the National Electric Light Association, announces as follows: For the accommodation of New England delegates to the National Electric Light Association convention at Denver-Colorado Springs, June 6 to 11, arrangements have been completed to run a special car from Boston to Denver, leaving the Terminal Station, Boston, on the Federal Express at 7.45 p.m., Friday, June 2, which car will be attached to the special convention train from New York to Denver, leaving New York City June 3 at 10.25 a.m., arriving at Chicago at 8.25 a.m., June 4, and arriving at Denver at 2.30 p.m., Monday, June 5.

INDUCTION WATT-HOUR METER.—An electrical energy meter possessing unusual mechanical features forms the subject of a patent issued May 16 to Mr. Albin May. The meter differs essentially from the familiar so-called induction integrating wattmeter in that the rotor armature consists of iron and forms a part of the magnetic path for the field produced by the current in the shunt coil. The shunt coil is so placed that the field is directed perpendicularly both to the turning axis and to the field produced by the load current. The coil for the latter current is free from iron in the magnetic path. Around the iron ring which constitutes the armature is wound a large number of turns of bare copper wire whose coils are in metallic contact with one another and with the iron ring. The object of the construction is stated to be the attainment of a strong torque with a light weight of the moving system.

TROLLEY IN TRINIDAD.—Mr. W. R. Holloway, United States Consul-General at Halifax, N. S., reports as follows: "Canadians who are taking an active part in the development of the British West Indies have just realized a handsome profit ($750,000) from the advance in the price of the stock of the Trinidad electric and tramway power plant in Port-of-Spain. Not only has the value of the stock increased by a clean $750,000, but dividends of 5 per cent have been paid for two years, and the net earnings are equal to 8 per cent on the capital earnings, which continue to show a heavy increase month by month. The dividend of 5 per cent is equal to 25 per cent on the original amount paid for the stock. Still greater and more expanding revenue will be assured with the carrying out of proposed extensions through a populous and fertile country to other towns in Trinidad. The present power station is sufficient to supply not only interurban tramway connection but light and power for these further demands upon it."

WIRELESS TELEGRAPHY.—A patent granted May 16 to Mr. R. H. Rendahl and Prof. F. Braun relates to that form of wireless transmitting devices in which several separate spark-gaps are contained in the oscillating system. It is well known that the exciting energy of the oscillating system can be increased by increasing the discharge potential by enlarging the spark-gaps. It is found, however, that although the resistance of the gap increases directly with increase of its length, with an enlargement of the spark-gap beyond four millimeters the potential at the poles of the gap no longer increases proportionately to the spark-gap, but more slowly; hence, it is impossible efficiently to enlarge the discharge energy by increasing the gap. The inventors remove the limiting gap length by connecting in series several separate spark-gaps, each of which does not exceed the allowable limit. In a second patent granted to Prof. Braun on the same date, it is proposed to distribute the whole capacity of the oscillating system over the circuit conductors between the separate spark-gaps. It is claimed that by this method the damping of the oscillating system is considerably diminished or the exciting energy is highly increased.

BLOTTING OUT ROOSEVELT.—It is stated that Roosevelt is to be obliterated by the highest dam in the world. This item does not concern the President or the sentiments of railroad managers, but a little town in Arizona, where the engineers of the Reclamation Service are to have complete in 1908, a huge dam on the Salt River—not the one up which politicians go sometimes, but a stream that is expected to yield abundant power. The contract for the Roosevelt dam has been recently given to J. M. O'Rourke & Co., of Galveston, Texas, and the most serious work of the project will soon be under way. During the past year, however, a vast deal of important preliminary work has been accomplished by the inhabitants of Roosevelt. A temporary power plant, a cement mill, an ice plant, a lighting plant and a saw mill have all been completed. The power canal, which will furnish water power for the generation of electricity to operate all the works, will be completed in a few months. A telephone line connecting the headworks of the power canal, about 18 miles above Roosevelt, with the Arizona dam, which is about 30 miles from Phoenix, has also been installed. A temporary steam-electric plant has been installed. When the work is finished Roosevelt will be 172 ft. below the surface of the water.

TELEPHONY IN INDIANAPOLIS.—The independent telephone interests in Indianapolis have recently had a great celebration to mark their sixth anniversary, the movers in the affair being the Indianapolis Telephone Company and the New Long-Distance Telephone Company. Mr. S. P. Sheerin, head of the independent movement and enterprises in the vicinity, came in for a special meed of praise. Judge R. S. Taylor, of Fort Wayne, sent a letter of regret for inability to be present. In this letter he said that though the Bell Company's holding its fundamental patents until their legal limitation was exceedingly costly to the people, when it attempted to retain its hold through the Berliner patents, the courts terminated these and the field was open to free competition along the most fundamental lines. The entry of the independents stimulated invention to a higher degree. Competition has brought improved service. He wrote, "I think there is nothing of importance now threatening the growth and success of independent telephony. I think we are near the end of litigation that will have in it any element of injury to public interests. Three or four suits now pending will have to be tried pretty soon or they will survive the patents on which they are brought. These are all that threaten the continuance of untrammeled telephone service to the people. But the art is now secure in its ability to serve the public interest without the burden of any fundamental monopoly." President Hoge, of the National Interstate Telephone Association, urged a full attendance at the Chicago convention, June 20 and 21.

Electrical Equipment of a Railway Shop.

IN many of the steam railway repair shops which were designed long before the idea of electrical driven shops had gained much prominence, the subsequent adoption of motor drive was simply a series of separate problems concerning the best methods for providing each machine with a motor. The Dale Street shops of the Great Northern Railway Company at St. Paul, however, were designed initially for motor drive. The design in itself presents several interesting features, notably the equipment of the power house and the system of distribution.

The most notable fact in connection with the shops as a whole is

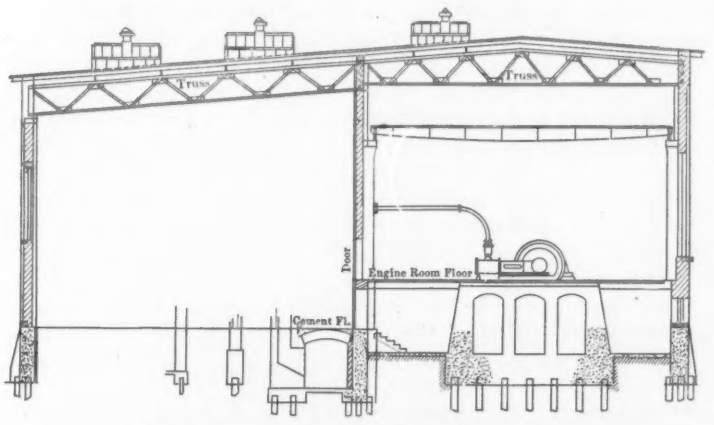


FIG. 1.—SECTIONAL VIEW OF POWER HOUSE.

that they are driven throughout by three-phase induction motors. There is in the installation no direct-current machinery whatever other than the necessary exciters for the generators. Previous to the installation of this equipment, the general idea prevailed that induction motors were not suitable for service where variable speeds were desired. In several instances induction motors were adopted for the constant-speed machines, while cranes and machinery requiring variable speeds were equipped with direct-current motors. In such a mixed system there are produced many complications. Great stress was laid by the motive power department of the Great Northern Railway on the importance of avoiding these complications. Although the idea of using induction motors exclusively was contrary to the then existing practice, the successful operation of the system for almost two years has proved the wisdom of the selection of this type of motor.

The power house, a cross-section of which is shown in Fig. 1, is in every respect a modern one, laid out on careful lines. It is, moreover, interesting from the fact that all the auxiliary apparatus is driven by induction motors of the same type as those installed in the shops. The building is of brick, with steel trussed tar and gravel roof. As a peat bog 20 to 30 ft. thick underlies the power house, a pile foundation was necessary. The piles were driven through the peat bog into a firm stratum of gravel underneath. They were capped with solid concrete, and upon this were constructed the concrete foundations for the buildings and for the machinery.

The boiler room contains at present five 288-hp Edgemoor boilers. Space has been left for a sixth boiler, which will be installed in the near future. Superheaters consisting of a nest of three tubes are placed between the boiler drums. The boilers are equipped with Murphy automatic stokers, and these have given excellent service. The lower grades of coal purchased by the railway company which are unfit for locomotive service, are burned in the furnaces with satisfaction. Some of this coal is of such an inferior quality that the evaporation factor is as low as three pounds of water per pound of coal. Montana coals have been burned in the furnaces successfully.

A Mead system of coal conveyors supplies the overhead bunkers. A spur from the railway tracks runs along the north side of the boiler room. The coal is dumped from the railway cars into a hopper between the rails. After passing through a crusher, a rubber canvas cross-belt conveyor carries the coal to a bucket conveyor which runs lengthwise of the boiler room and makes a complete circuit above the bunkers, over the boilers and below the ash pits. This conveyor automatically dumps the coal into the overhead bunkers, and carries the ashes from the pits to a bunker similar in construction to that of the coal bunkers. Ashes are removed from this bunker to cars on the track outside by a screw conveyor. A 30-hp induction motor, installed on the boiler room floor, drives the crusher and the cross-belt conveyor, while the longitudinal bucket conveyor and the spiral ash conveyor are driven by a 10-hp motor of the same type.

The Sturtevant system of induced draft is installed. The flue gases pass from the boiler to a tunnel running underneath the boilers the full length of the boiler room. The location of the tunnel is shown in Fig. 1. The tunnel, together with the Green economizers above the boilers and the connecting upright flues, makes a passageway for the gases completely encircling the boilers. From the tunnel the gases may be conducted by way of the upright flue to the west of the boilers and through the economizers, or they may ascend at the opposite end of the boiler room and pass directly to the exhaust fans.

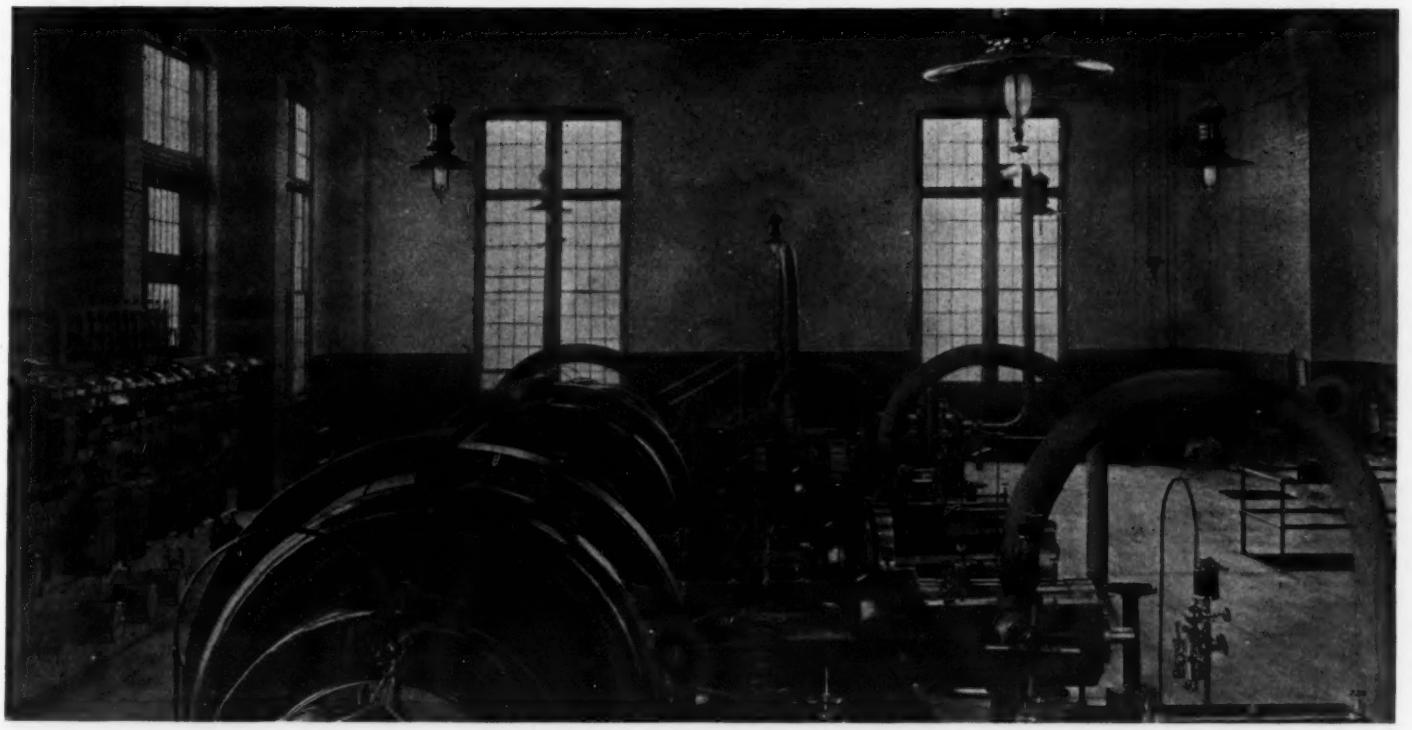


FIG. 2.—INTERIOR OF ENGINE ROOM.

The scrapers of the Green economizers are driven by a 3-hp induction motor. Although this motor is exposed to the dirt and dust due to the handling of ashes and coal, and it is installed in an unusually hot place, no trouble whatever has been experienced in its operation. The two fans of the induced draft system are 10 ft. in diameter and 58 in. wide, and one alone is of sufficient size to care for the entire boiler capacity. They are driven independently by two 10 by 12-in. Sturtevant horizontal engines. The fans themselves are located above the boilers, on the steel framework supporting the bunkers and economizers, while the driving engines are installed on the boiler room floor. Rope drive transmission between the engines and fans is employed.

A Blake vertical tandem compound duplex pump, having a capacity of 6,000 gallons of water per hour, furnishes the feed water. Water is pumped directly from the hot well at a temperature of about 140° F. Before being admitted to the boilers it passes through the economizers, where the temperature is increased to approximately 240° F. In case of emergency, a Worthington duplex fire pump may be utilized to feed the boilers. This is a 12 by 8.5 by 10-in. pump connected between the city water supply system and the high-pressure system of the shops. A Fischer governor maintains the latter system at a pressure of 150 pounds.

A line of 7-in. steam pipes passes from the boilers to the main header. This header, which is 14 in. in diameter, is supported a few feet from the floor by brackets secured to the dividing wall between the boiler and engine rooms. From the end nearest the shops there is taken off a 6-in. main which leads to the steam hammers and other apparatus in shops. The mains to the separate engines in the operating room and to the condenser pumps in the basement pass directly through the intervening wall, the steam being controlled by gate valves near the header and throttle valves at the apparatus.

The illustration (Fig. 2) shows the general arrangement of the engine room. The condensers, condenser pumps, hot well and other auxiliary apparatus are installed in the basement. At the extreme west end of the room is an Ingersoll-Sergeant, class G, cross-compound air compressor, having a capacity of 1,349 cu. ft. of free air per minute at 115 pounds pressure. The compressor is built to run condensing with steam at 150 pounds pressure. A 3-in. pipe from the city water main supplies cooling water to the air cylinders as well as to the intercooler located in the basement.

Two exhaust headers are provided for the several engines. One of these, an 8-in. main, leads to the atmosphere, and the other, 16 in. in diameter, is connected to the condensers, which are of the Worthington jet type, one having a capacity of 18,000 pounds of steam per hour, the other a capacity of 7,200 pounds. The condensers are installed in connection with Worthington vacuum pumps and a Worthington cooling tower. The cooling tower has a capacity of 30,000 pounds of water per hour, cooling this amount from 125 to 70° F. The double fan, which is placed at the base, is driven by a 40-hp induction motor installed in a small house near by. The exhaust mains from the engines to the vacuum exhaust header are provided with gate valves. A back-pressure valve is provided for each engine, and a relief valve in the exhaust main leading to the atmosphere opens automatically in case of failure of the condenser. The Webster system is employed for the heating of the entire shop plant by means of direct steam—utilizing both live and exhaust steam. The vacuum pumps for this system are located in the basement of the engine room.

A gravity oiling system is provided for the several engines and machines. The oil drains to a Burt Cross filter in the basement. A Blake 2 by 1.25 by 2.75-in. duplex pump draws the oil from the basement to an overhead storage tank, and from the tank the oil is distributed to the bearings. Four direct-connected generating units, consisting of Buckeye engines and General Electric generators are installed. The two larger engines, which drive the power dynamos, are of the cross-compound type, and have cylinders 13 by 25 by 21 in. They are connected to three-phase, 60-cycle, 480-volt generators, each of 210 kw capacity. There is in use for enclosing the crank case a very satisfactory oil shield which was designed by engineers of the Great Northern Railway. The one lighting unit is of smaller capacity, being driven by a cross-compound engine with cylinders 10 by 20 by 14 in. The generator is similar in phase, frequency and voltage to the larger ones, but is of 110 kw capacity. The fourth unit consists of a simple condensing engine and a 35-kw, 125-volt, direct-current generator for exciting the fields of the alternating-current generators during the starting period. Each cross-compound engine is provided with two governors, one on either side of the generator. To assure the proper relative positions of the cut-off valves of the high and low-pressure cylinders at all loads, the two governors are connected rigidly together. The connecting shaft runs parallel with, and in close proximity to, the main shaft. Where the main shaft passes through the revolving field spider, a channel is cut into it for the reception of the governor shaft. For supplying current for field excitation after the plant is in operation, there is installed a 13.5-kw motor-generator set consisting of an induction motor connected to a 125-volt, direct-current generator. This exciter, as well as the one driven by the engine, is flat compounded. The leads of the two larger generators are of 400,000 cm. capacity, those of the generator connected to the lighting circuit being 00 wire. All the generator leads are carried to the switchboard underneath the floor in unlined loricated conduit.

The switchboard consists of seven panels of blue Vermont marble, including three generator, one exciter, one lighting feeder, and two power feeder panels. The usual instruments, including a frequency meter and a Lincoln synchroscope, are provided. This latter instrument is mounted on the wall of the building, back of the switchboard and just below the crane runway. In this position it may be read by the engineer at the engine, as well as by the man operating the switchboard.

The connections of the board were arranged with the idea of avoiding parallel operation of the generators as much as possible, of providing duplicate connections in the event of failure of those in use, and of permitting extreme flexibility in the shifting of the load or portions of the load on the different machines. A notable feature is that the generators are not protected by fuses or automatic circuit-breakers. The drooping voltage characteristic of the generators is depended upon to protect them in case of short-circuits at the bus-bars. Manually operated breakers, however, are provided. These, with the levers controlling them, are to be seen in the reproduction of the switchboard.

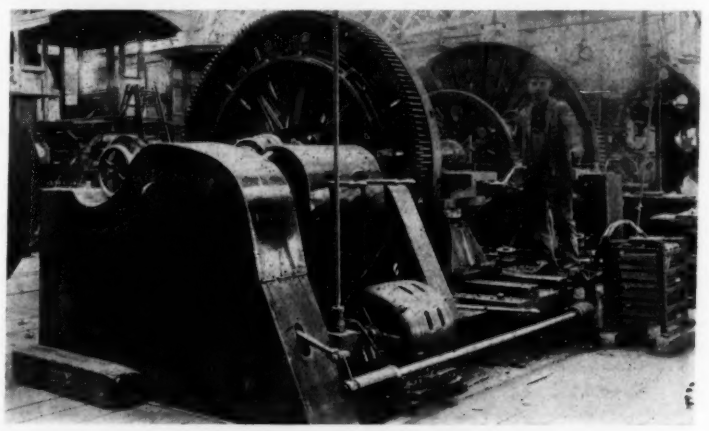


FIG. 3.—VARIABLE-SPEED MOTOR DRIVING A 96-IN WHEEL LATHE.

The wiring of the switchboard is such as to permit of extreme flexibility. The power generators may be connected directly to either of two sets of power bus-bars by means of double-throw switches. The downward position of the double-throw switch which controls the lighting generator circuit, throws this generator on the lighting circuit bus-bars. The upward position connects it with the upper set of power bus-bars. Another double-throw switch connects the lighting bus-bars to either set of the power bus-bars. The double-throw switches of the power and lighting feeder circuit permit these to be thrown on any of the sets of main bus-bars. To avoid parallel operation and the attendant uncertainty in synchronizing, the station is usually operated by distributing the power load equally between the two large generators and throwing the lights on the smaller unit. The back of the board presents an unusually neat appearance. The field rheostats which are placed under the floor are operated from the switchboard by means of sprocket chains.

The conduits carrying the power and light feeders pass from the switchboard to the southwest corner of the boiler room. Here they enter the distributing tunnel system, and through this they pass to the several shops. This system of tunnels contains steam and air pipes as well as the electrical conduits. It is quite extensive, passing underneath the several shops and having a total length of

about 1,500 ft. With the exception of a lateral branch to the storeroom, it measures 7 by 7 ft., and is constructed entirely of concrete. Of the eight conduits which enter the tunnel, four contain power cables, two of which carry 300,000-c.m. cables supplying power to the machine shop, one carries cables of the same size to the blacksmith shop, while another carries cables which branch to the storehouse and the boiler shop. The four remaining conduits carry cables for illumination service in the machine, boiler, blacksmith shops and storehouse.

In each instance the illumination cables pass to banks of two transformers, which are connected to transform from three phase to two phase with neutral wires. This gives 220 volts between outside wires and 110 volts between the neutral wires and outside ones. A total of 205 kw of transformer capacity is installed. Usually one bank of transformers is placed in each shop. The machine shop, however, contains two sets. A set of 20 kw capacity each is located in the south end of the shop, while a 15-kw set is in the northern portion. The secondaries of the two sets are arranged to be interconnected in case one set fails. In most instances the transformers are located in the tunnels, being hung from brackets on the walls near the roof. From the transformers, leads are carried under the floor to distributing boxes on the shop walls. The transformers serve 1,200 incandescent and 180 arc lamps, these latter being of the alternating-current, multiple type. In some cases they

FIG. 4.—WALKING JIB CRANE.

are hung from the overhead structure, but in numerous instances a tubular steel pole supports them. Many of the incandescent lamps are supported on brackets which permit the lamps to be placed in such a position as best to throw light on work in the machines.

Two separate lines of power feeders are carried to the machine shop because of the serious consequences of a failure of the power in this room. As previously stated, either or both of these feeders may be connected to either set of power bus-bars on the station switchboard. The other feeders terminate in a junction box secured to the roof of the tunnel under the machine shop. Two open feeders emerging from the box each supply one section of the shop. By means of a double-throw switch, either one or both of the main feeders may be connected to either of the open feeders running to the machines. This arrangement, together with that of the switchboard, gives two independent feeder systems between the generators and the motors in the machine shop.

Outlet boxes are placed where the separate loads branch from the main feeders in the tunnels to the motors. These lateral leads are carried under the floor in loricated conduit to the compensators (starting transformers) installed in connection with the motors. The compensators for those machines which are started and stopped frequently are usually placed on a post convenient to the machine. The compensators of those machines not frequently stopped are usually placed in a group, for the manipulation of which one man is made responsible.

In and about the shops there is a total number of 84 General Electric induction motors, having an aggregate of 903.5 hp. These are in a service as varied as would ordinarily be encountered in any railway repair shop. Because of their isolated position, many of the machines were necessarily equipped with individual motors, but a general effort was made to use a single motor to drive groups of the smaller machines requiring frequent starting and stopping. The motors in these instances are placed overhead on the timbers which support the line shafting. Many of the machines are directly geared to the motors. In several instances, however, Renold chain drive is used, and in other cases leather belting of the usual type is employed. In most cases Renold chain drive was employed in fitting the motors to the old belt-driven machines which were originally located in the old Jackson Street shops.

The accompanying list shows many of the features of the separate installations and is especially valuable in that it gives the rating of the motors which were selected for driving machines of standard type. After the first few months of operation, it was found in several instances that the motors were either too large or too small for the machines. These motors have since been changed, and this list shows the power rating that practice has proven best suited for the work. The list gives the size of the motor, the method by which it is connected to the machines and the machines which it drives. Unless otherwise indicated, the motors are of the constant-speed type. Motors which are specifically referred to elsewhere in this article are not included in the list.

POWER REQUIRED BY VARIOUS TOOLS.

Niles 96-in. driving-wheel lathe, chain connected, 10 hp.
Group, overhead belted. Niles 42-in engine lathe; emery wheel; Craven quartering machine, 5 hp.
Niles double axle lathe, chain connected, 7½ hp.
Niles 48-in car wheel lathe, chain connected, 10 hp.
Sellers planer, 54-in. x 54-in., belted overhead, 10 hp.
Niles 8-ft. boring mill, chain connected, 10 hp.
Niles 8-ft. wheel lathe with quartering attachment, variable-speed motor, chain connected, 10 hp.
For driving quartering attachment to this lathe, two motors, chain connected, each 3 hp.
Fairbain, Kennedy & Naylor 72-in. driving-wheel lathe, belted overhead, 7½ hp.
Putnam 79-in. driving-wheel lathe, belted overhead, 7½ hp.
Niles 96-in. driving-wheel lathe, chain connected, 10 hp.
Group, belted overhead. Becker Brainerd No. 6 vertical miller; Becker Brainerd No. 7 vertical miller; emery wheel; Niles 30-in. shaper; Bement Niles No. 2 Cotter drill; Niles vertical boring mill; Niles 24-in. drill press; Niles 4-spindle drill, 15 hp.
Niles double axle lathe, chain connected, 7½ hp.
Niles 48-in. car-wheel borer, for driving tool, chain connected, 7½ hp.
For driving hoist—geared, 3 hp.
Niles 48-in. hydraulic wheel press, belted overhead, 5 hp.
Group, belted overhead. Niles 6-spindle drill; Niles 24-in. shaper; Bement Niles 15-in. slotter; Niles gap lathe 24-in. x 48-in.; Niles lathe 28-in. x 14-ft.; Niles lathe 18-in. x 8-ft., 15 hp.
Bement Niles 18-in. vertical slotter, chain connected, 10 hp.
Tool room group, belted overhead. Brown & Sharpe milling machine; S. C. Wright 16-in. lathe; Bement & Son 9-in. shaper; Niles-Bement-Pond No. 2 milling machine; Niles-Bement-Pond cutter grinder; Sellers twist-drill grinder, 7½ hp.
Niles 7-ft. boring mill, belted overhead, 7½ hp.
Group, belted overhead. Bement 32-in. drill press; Lodge & Davis 22-in. lathe; Gisholt 21-in. turret lathe; Niles-Bement-Pond Co. 20-in. lathe, 10 hp.
Group, belted overhead. Pond engine lathe, 36-in. x 17-ft.; Pond engine lathe, 36-in. x 20-ft.; Niles engine lathe, 30-in. x 16-ft.; Gisholt universal tool grinder, 10 hp.
Group, belted overhead. Niles spindle drill; Newton cold saw; Niles-Bement-Pond lathe, 20-in. x 10-ft.; 3 Jones & Lawson turret lathes, 2-in. x 24-in; Gisholt 24-in. turret lathe; No. 2 water emery wheel, 15 hp.
Group. Gisholt 28-in. turret lathe; Niles-Bement-Pond Co. 24-in. drill press, 10 hp.
Pond planer, 32-in. x 10-ft. belted overhead, 5 hp.
Niles 30-in. x 30-in. planer, geared, 5 hp.
Group, belted overhead. Gisholt, 34-in. turret lathe; Niles No. 2½ horizontal boring mill; Niles 22-in. lathe; Lodge & Davis 18-in. lathe; Le Blond No. 3 milling machine, 15 hp.
Group, belted overhead. Niles 20-in. shaper; Niles-Bement-Pond Co. 12-in. pipe machine; Niles 16-ft. radial drill press, 5 hp.
Niles 60-in. x 60-in. planer, overhead belted, 15 hp.
Pond 48-in. x 48-in. planer, chain connected, 10 hp.
Niles 60-in. horizontal boring mill, variable-speed motor chain connected, 3 hp.
Group, overhead belted. Brass room, Lodge & Davis lathe; 2 Niles 18-in. lathes; 2 Fox 18-in. lathes; 2 Niles-Bement-Pond Co. 18-in. lathes; 2 Fox 16-in. lathes, and emery wheel, 10 hp.
Group, belted overhead. Niles lathe, 28-in. x 14-ft.; Wm. Bement 16-in. slotter; Wm. Bement 12-in. slotter; 2 Niles lathes, 26-in. x 12-ft.; Niles 24-in. shaper; Bement Niles 12-in. shaper; Springfield Mfg. Co.'s No. 5 oscillating surface grinder; Springfield Mfg. Co.'s face and variety grinder, 15 hp.
Group, overhead belted. Pond lathe, 28-in. x 20-ft.; Niles-Bement-Pond 21-in. drill press; Niles screw machine; Niles engine lathe, 36-in. x 16-ft.; Bement 24-in. drill press; No. 2 water emery wheel; Niles 18-in. extension lathe; Fitchburg 32-in. lathe; Bement 50-in. drill press; centering machine, 15 hp.
Niles 30-in. double-head shaper, belted overhead, 5 hp.
Tin shop. Bliss press and rolls, belted overhead, 10 hp.
Group, belted. Niles 4-spindle drill with sliding table for drilling mud rings; Bement Niles 10-in. vertical drilling machine; Putnam 18-in. drilling machine, 75 hp.
No. 2 Long & Allstatter double punch and shear, chain connected, 7½ hp.
Group. Niles 7-ft. plate-bending roll; Ajax 12-ft. plate-bending roll, motor on floor, chain connected to countershaft and belted to tools, 20 hp.
Kneeland No. 1 R lever shear for 1¼-in. square steel, bolted overhead, 5 hp.
Lloyd-Booth No. 6 lever shear for scrap, geared, 7½ hp.
Williams, White & Co.'s No. 2 bulldozer, geared, 5 hp.
Ajax forging roll, motor on floor, belted, 10 hp.
No. 10 Sturtevant steel pressure blower, motor on floor, belted to overhead countershaft, belted to blower, 40 hp.
Morgan double punch and shear, chain connected, 10 hp.
Newton No. 3 bar cold saw, chain connected, 5 hp.
Group. Blakeslee 1-in. forging machine; 2 Blakeslee 2-in. forging machines; 1½-in. forging machine, on floor, belted to overhead countershaft, 40 hp.
Group. 2 Acme 1½-in. 6-spindle nut tappers; Oliver 8-spindle nut tapper; Acme 2-in. double bolt cutter; Natl. 1½-in. double bolt cutter; Lewis & Oliver 1-in. double bolt cutter; 2 Acme 1½-in. double bolt cutters; Acme

5-in. single bolt cutter, motor on floor belted to overhead shaft, Acme 1½-in. single bolt cutter; 30 hp.
Flue shop. 2 Hartz flue welders; combined flue cutter and tester, ovehead belter, 7½ hp.
Outdoor flue rattler, 34-in. diam. by 16-ft., motor on floor in separate inclosure, belted, 7½ hp.
Tank shop. Small Gramo-Klausman band saw, overhead belted, 5 hp.
Physical laboratory. Testing machine, motor on floor, belted, 5 hp.
Brass foundry. 2 car brass boring machines; Root positive blower; rattler; overhead belted, 10 hp.
Stores dept. Incline, movable platform, variable-speed motor, chain connected, 3 hp.

One of the chief features of interest in the installation, as has been previously stated, is the successful operation of variable-speed induction motors. The cranes, transfer table, wheel lathes and several other machines are driven by motors capable of speed variations. One example of this class is the Niles 96-in. driving-wheel lathe shown in Fig. 3. In this instance the controller, as may be seen, is located within easy reach of the operator. In all the variable-speed installations the different speeds are obtained by inserting resistance in the secondary circuits. The controller also permits of reversal of direction of rotation. This being accomplished by interchanging two of the three leads of the primary. In the illustration of the wheel lathe, the rheostats in connection with the control circuit may be observed immediately behind the controller. These are provided with sufficient radiating surface to permit continuous operation of the motor at any speed without undue heating.

Another variable-speed installation is shown in Fig. 4. This is one of two walking jib cranes which were manufactured by the Whiting Foundry Equipment Company, of Harvey, Ill. For each crane there

FIG. 5.—TRANSFER TABLE OPERATED BY THREE-PHASE MOTOR.

are provided two motors, one of 7.5 hp, installed on the base, which produces travel of the crane at a speed of 125 ft. per minute, and another, on the jib, which operates the hoist. This latter motor, of 10 hp, is provided with an alternating-current solenoid brake, as are all the hoist motors on the overhead cranes. Current for the motor passes through a solenoid and raises an armature, thereby releasing a friction brake whenever current is on the motor. The overhead cranes are all controlled from the floor by chair pendants. The 20-ton crane in the boiler shop is equipped with a 15-hp motor for the hoist, a 10-hp motor for the cross travel and a 3-hp motor for longitudinal travel. Each of the two bridge cranes in the machine shop is of 2.5 tons capacity. Each is equipped with a 3-hp motor for the hoists and one of similar size for the bridge travel while racking is done by hand. The tank shop is also equipped with similar motor-operated cranes.

The transfer table, shown in Fig. 5, as furnished by Geo. P. Nichol & Bro., is equipped with a 20-hp variable-speed motor. The three-phase overhead trolley line is well shown in the illustration. On the storage platform there will be used a revolving locomotive type crane which is now being built by the Garry Iron & Steel Company, of Cleveland. The crane will have a maximum lifting capacity of 5,000 pounds, and will be equipped with a 7.5-hp motor for hoisting, and one of 10 hp capacity for travel and for revolving the jib.

Another special equipment is the one used in connection with the drop table in the machine shop. The 20-hp motor which operates the table is installed in an adjacent pit. The interesting feature in connection with the electrical equipment is the arrangement by which the motor is stopped automatically when the table reaches certain limits of travel. When the motor is stopped by the device it cannot be started until reversed. The connections of the controller by which this is accomplished are shown in Fig. 6. Lugs permanently attached to the moving table operate dogs which, in turn, open the switches. Assume the upper switch in Fig. 6 to be opened; as long as the circuit through this switch is open, the motor cannot be started through F_1 and F_2. To start it through FF_1 and FF_2 it is necessary to reverse the motor, and this action lowers the table.

The motor that is exposed to more dirt than any other of the

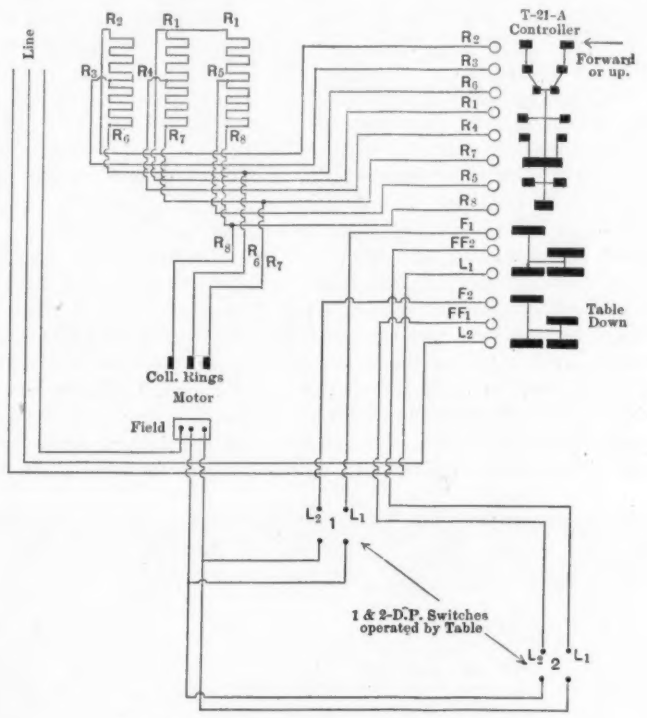


FIG. 6.—DIAGRAM OF CONTROLLER WIRING

whole installation is probably the one driving the flue cleaner. The deposit on old boiler flues is removed by means of a rattler, into which they are placed. The motor driving this apparatus, although partly protected by a wooden house, is so exposed to the flying dust that all the stationary parts are deeply coated with deposit. A direct-current motor installed in this place would no doubt be continually in need of attention, but the induction motor in service has required no attention other than an occasional oiling and cleaning.

An example of the heavier individual machines in the shops and the methods by which they are connected to the motors is shown in Fig. 7, where the 30-hp motor, mounted on the housing of the

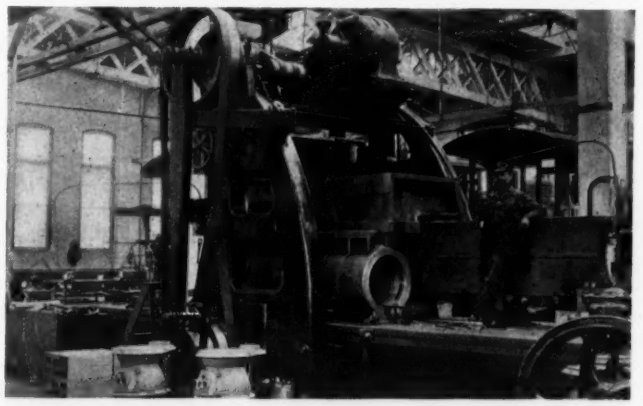


FIG. 7.—MOTOR-DRIVEN PLANER.

84-in. by 84-in. planer, seems extremely small for the work it performs. A 40-hp motor serves for driving one of the blowers for the forge room. A similar blower equipment is installed in another portion of the boiler shop, the blast ducts being interconnected. A Long & Allstatter punch and shear, which was originally a belt-driven machine in the Jackson Street shops, has been equipped for motor drive. A supporting frame was constructed, and the motor mounted in a manner such as not to interfere with the working of the machine. Another heavy machine in the blacksmith shop is an Ajax forging machine, which is belted to a 20-hp motor. A method of installing a compensator near the machine controlled by it is

illustrated in Fig. 8 which shows a bevel shear driven through several sets of reducing gears by a 5-hp motor.

The question often arises as to whether or not the increased first cost of an induction motor installation over that of a direct-current system is warranted by the advantage of the alternating-current system. The motive power department which was in direct charge of this installation, is firm in the belief that it is. It is stated that in the two years of operation of the shop system not one dollar has been spent for electrical repairs to motors. Only one man is required to care for the entire electrical equipment, viz.: power house apparatus, motors, arc and incandescent lamps. It is impossible

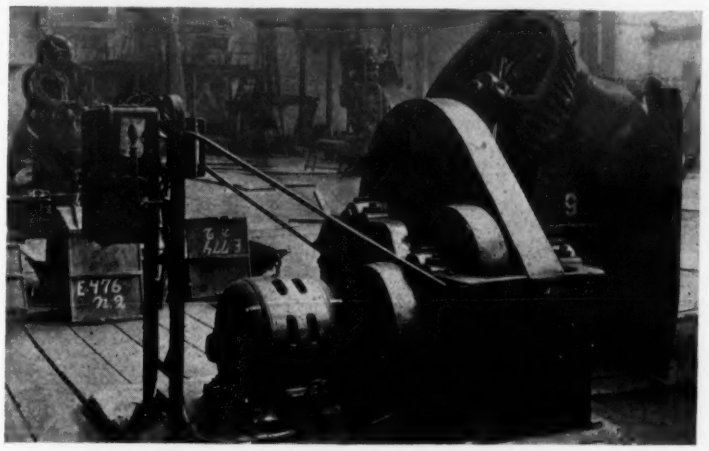


FIG. 8.—MOTOR-DRIVEN BEVEL SHEAR, SHOWING STARTING TRANSFORMER.

to estimate what the maintenance expenses of a direct-current system subject to the same usage would be, but the difference between the two systems would no doubt pay interest on a considerable portion of the increased investment in the alternating-current system.

The questions of first cost and maintenance expenses, however, are of minor importance when the inconvenience and the indirect cost connected with the breakdown of the motive power in such a shop are considered, and it might be stated that the greater reliability of the induction motor was the determining factor in the selection of equipment for this installation.

The entire electrical and mechanical equipment was selected and installed by the motive power department of the Great Northern Railway line.

Electric Motor Connections to Machine Tools.

The electric drive in machine tool work has come to involve more than merely mounting a motor upon a machine in the quickest and most convenient manner—it now embraces some of the most important of the economic considerations of shop operation—and includes, in addition to the securing of a neat and strong bracket support, a scheme of mechanical connection to the driving shaft of the tool by which two or more changes of speed may be obtained outside of those available in the motor. The highest speed ranges obtainable in commercial motors are 4 to 1 and 5 to 1, while the average lathe requires a range of speed available of over 7 to 1. This is now customarily obtained by gearing changes in individual driving, and for this purpose interesting designs have been worked out.

The accompanying illustrations will show developments in the direction of lathe driving that have been made by the Pond Machine Tool Works branch of the Niles-Bement-Pond Company, the latest of which has many points of interest. The engineers of this company have made a careful study of the problem with the result that their lathes have been very materially changed in design to adapt them to the conditions imposed by the electric drive, and make the combination most flexible and efficient in operation. It has been the practice of this company to provide from two to four changes of speed by gearing in the headstock of the lathe, depending upon the range of speeds available from the motor, as well as also the purpose for which the lathe is to be used and the working range required. This is without question representative of the best practice in this line, although it involves a complete departure from former practice and existing types of tool construction.

The effect that this departure has had upon tool construction is interesting. Upon lathes it has resulted in a complete change in design of the headstock and driving gear, as are illustrated herewith. The effect upon milling, drilling and boring machinery has been similar, while planers and shapers have been less affected in design. The accompanying illustrations present examples of the changes that have been made which warrant careful study.

The earliest attempts in the line of lathes involved the use of supporting brackets spanning across the space formerly occupied by the stepped belt pulley, as indicated in Fig. 1, which shows a Crocker-Wheeler multiple-voltage drive upon a 30-in. Pond lathe. In some cases these brackets carried the trains of gears by which the speed changes are obtained, while in others the headstock design was changed to accommodate the new runs of gears in itself, although the deviation from the original style of belt-driven head-

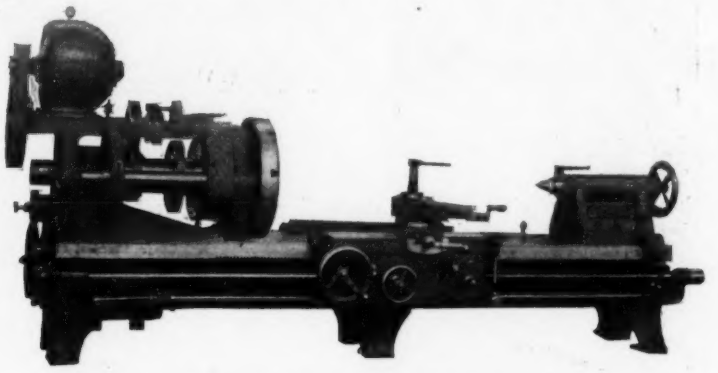


FIG. 1.—30-IN. LATHE, CROCKER-WHEELER MOTOR.

stock was comparatively slight. The tendency to apply the motor drive to the lathe unaltered from its belt-drive form seemed to be the reason for thus withholding from radical changes, it being a notable fact that the earlier designs were so arranged as to permit a return to belt driving in its usual form with the least possible trouble, if found desirable.

The most recent designs, however, indicate that the motor drive has truly "asserted itself." The tendency is unmistakably to depart from all the traditions and restraints of the belt drive and secure an arrangement of driving which shall operate to the best possible advantage for the motor and thus produce a system so far in advance of any other that the motor will be considered absolutely unexcelled. Both the half-tones (Figs. 2 and 3) and the drawing (Fig. 4) illus-

FIG. 2.—42-IN. LATHE, WESTINGHOUSE MOTOR.

trate designs of lathe driving of this scope. From these it will be evident that the general exterior design of the headstock has been so changed as to bear no resemblance to the belt-drive form; it has, in fact, been entirely remodeled so as to accommodate the most desirable arrangement of the gear and clutches used for the speed changes available. There is also an apparent tendency to enclose the entire gear equipment in a protective casing, which will not only keep the gears free from dirt, metal chips, etc., but also protect the workman.

The drawing (Fig. 4) illustrates the latest and most improved design of the Pond Works for a motor-driven lathe headstock, and a study of the details of the drive will be of interest. The motor drives, as may be noted, through a gear reduction to a short coun-

tershaft T above the headstock frame, which countershaft is carried by the special motor supporting table or bracket. The countershaft carries three shifting gears, *A*, *B* and *C*, which are splined to the shaft and arranged to be controlled by two levers. They may be

FIG. 3.—72-IN. LATHE, GENERAL ELECTRIC MOTOR.

shifted to mesh with corresponding gears upon the intermediate shaft, *M*, although a special interlocking device prevents two combinations being accidentally geared in together with the consequent damage to the mechanism. Shaft *M* drives to the spindle, *S*, of the lathe through gears *B* and *F*, gear *F* being mounted upon a loose sleeve which carries pinion *H* at one end. This sleeve drives the spindle, for the higher speed drive, through the back gears, *H*, *J*, *K* and *L*, or for a slower and more powerful drive, through the triple gear combination, consisting of gears *H*, *J*, *D*, *E*, *G*, and then to the face-plate gear, as desired, these changes being made by means of a lever outside the headstock. This makes six changes of speed available at the face-plate, which with the 2 to 1 speed range in the motor gives a 12 to 1 total range for the lathe, which is most convenient, covering thus practically all speeds that will ever be required for any conceivable class of work which may be brought upon it.

The method of supporting the motor is neatly worked out. The

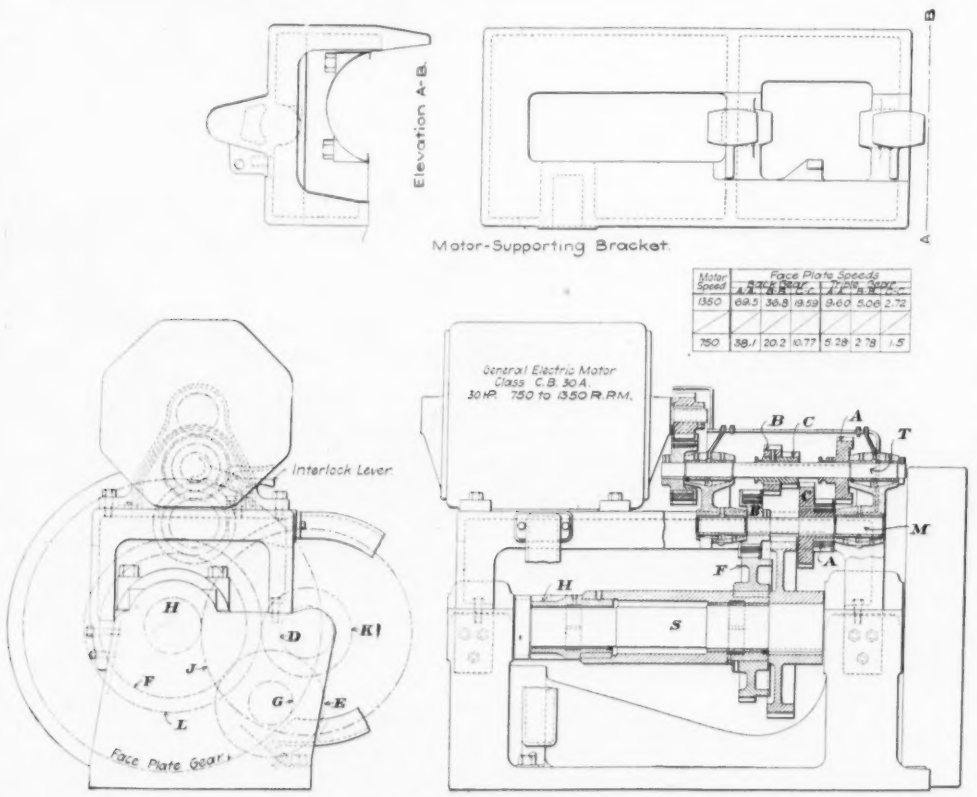


FIG. 4.—DIAGRAMS OF MOTOR-DRIVEN LATHE HEADSTOCK.

details of the special bracket or table are shown at the top in Fig. 4. The bearings for both shafts *T* and *M* are cast integral with it, thus making the motor drive and gearing all self-contained. It is designed to be bolted to the headstock frame without disturbing the bearing caps in any way, and free access is given to all parts of the mechanism. An interesting feature is to be noted in that this design permits the usual style of headstock frame to be used with practically no alteration. The use of the motor with a 2 to 1 speed range is thought preferable on account of its smaller size and consequent effect of lighter design for the bracket; all the advantages of

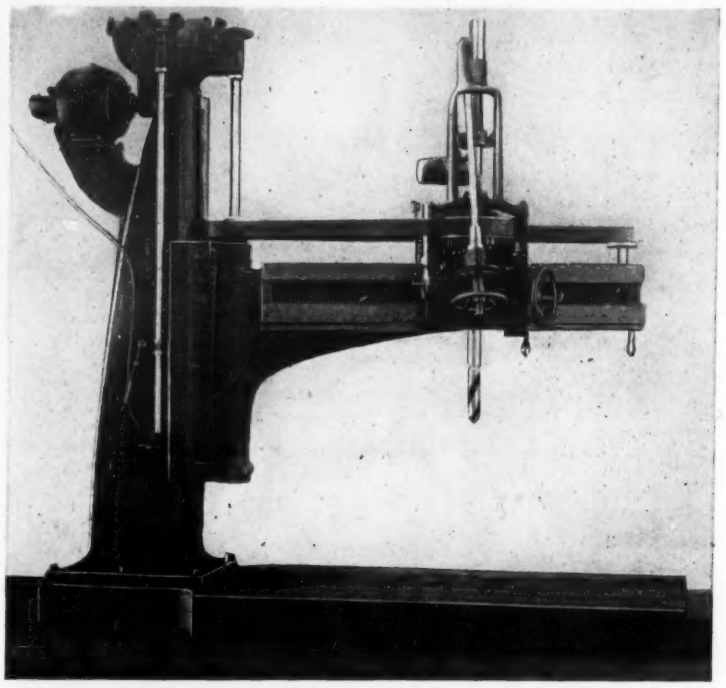


FIG. 5.—RADIAL DRILL, NORTHERN MOTOR.

the higher speed range motor are secured by the numerous gearing changes.

An excellent example of motor driving as applied to a radial drill is shown in Fig. 5, which illustrates a 6½-ft. Pond drill equipped with a Northern variable-speed motor, operating upon the two-wire system by field control. The use of belts in connection with the main drive is entirely eliminated so that the drive is not only not unsightly, but is positive and not rendered inefficient or deleterious by belt slippage. The motor is mounted upon a neat design of bracket located at the top of the column, from which the driving connection is made through a Morse silent chain; the chain combines the advantages of gear and belt driving, giving the silent and smooth action of the belt, and in addition is positive, like gears. This application has been so worked out as to cause very little change in the general design of the tool with the exception of the elimination of the belt cone pulleys and their brackets, the result being altogether a pleasing one as to appearance. The motor's variable-speed controller is very conveniently located upon the rear side of the radial arm, with the operating handle projecting downward so as to be always within reach of the operator.

The remaining illustrations show motor driving applications to planers. The application of motor driving to a planer involves less change in its design and construction than in the case of most other tools, the principal consideration being the supporting of the motor in the most suitable position for the drive. It has come to be generally accepted that in planer driving the motor is most easily accommodated upon the top of the side frame housings, as here it is not only out of the way, but is in close proximity to the driving point. The supporting method most generally employed involves the use of the cross yoke at the top, which is cast with a projection at the rear to form a supporting table or platform. This is done

with very little trouble and involves no change in the remainder of the design of the tool. The drive to the bed is carried through belts in order to procure the automatic reversing feature.

Fig. 6 illustrates a 48-in. Pond planer driven by a Northern constant-speed motor, the use of variable speeds being omitted in the case of the planer. The drive is here through a short silent chain to the countershaft carrying the fly-wheel, from which the reversible drive to the lower pulleys is made. The use of the fly-wheel is to be

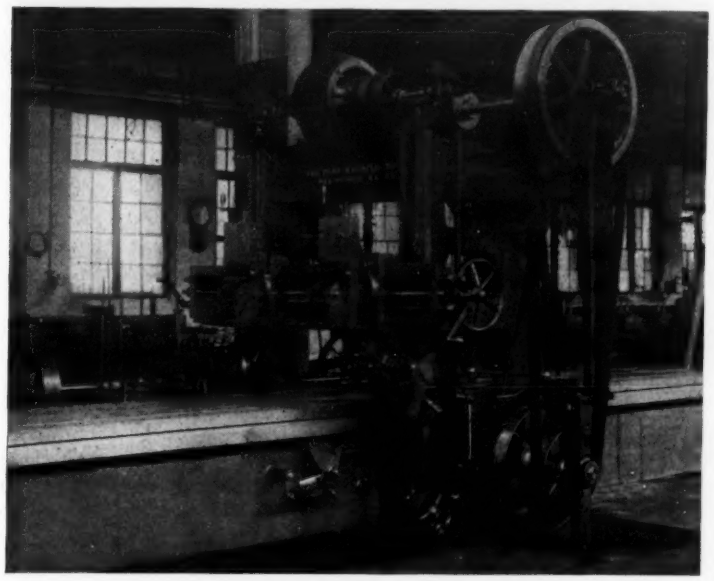


FIG. 6.—48-IN. PLANER, NORTHERN MOTOR.

noted as an important feature in that it very largely frees the motor from the mechanical shocks of reversing the bed; the shocks that come from the quick reversing of the bed and pulleys are found to be heavy and severe, and the use of the fly-wheel to assist the motor in "carrying by" by its inertia is very favorable to the motor and results in a much smoother action.

The planer illustrated in Fig. 7 is a 42-in. forge planer of similar

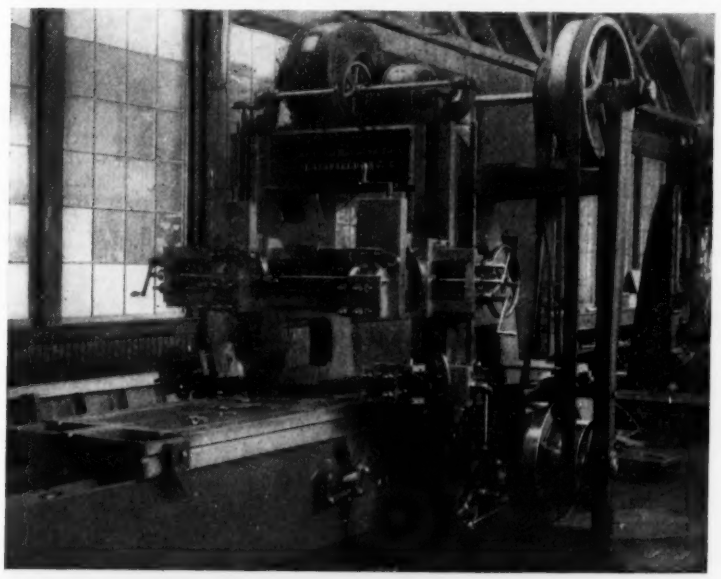


FIG. 7.—FORGE PLANER, WESTINGHOUSE MOTORS.

design, driven by Westinghouse motors, but which has, in addition to the main drive, an auxiliary motor for the raising and lowering of the cross rail of the planer. This operation is one of considerable magnitude in the larger sizes of planers and it can best be done by power. The advantages of the use of a separate motor in this connection cannot be overestimated—as a time-saver for the workman it is unrivalled, particularly as by it minute adjustments are made with ease.

Wireless Telegraphy in Germany.

BY A. FREDERICK COLLINS.

IN a pamphlet written by Count Arco, and recently issued by the Gesellschaft für Drahtlöse Telegraphie, much new light is thrown on the amalgamation of the Braun-Siemens & Halske and Slaby-Arco systems, and which are in their present combined form being designated simply as the System Telefunken.

It will be remembered that prior to the summer of 1903 the former system was exploited by the Gesellschaft für Drahtlose Telegraphie and the latter by the Allgemeine Electricitäts-Gesellschaft, and that both of the wireless equipments made by these companies had attained a world-wide reputation.

Then came a test of the merits of each in the German courts, not unlike the one through which the Marconi and De Forest interests have been involved in this country. Publicity of this kind is not only unenviable, but it is much more expensive than advertising at space rates, and it also has a deterrent effect upon the business of both companies, right or wrong.

After the legal differences of the German companies had been settled it was found possible and to the interest of all concerned, to combine the opposing factions, and after this was done all the efforts heretofore expended in developing plots and counterplots were concentrated on perfecting the apparatus, with the result that they now employ over one hundred men in their assembling and repair shops.

This force does not include those who make the specific parts of the apparatus, for the greater portion of the electro-mechanical devices are manufactured by Siemens & Halske and by the Allgemeine Electricitäts-Gesellschaft. After the different appliances are mounted a staff of nearly fifty skilled technicians and assistants take charge of the equipments, testing and finally installing them.

For testing purposes the company has in and around Berlin six different stations, where the range of transmission is determined and the efficacy of all the new arrangements can be accurately ascertained. These stations are furnished with ondometers and other special instruments for measuring the wave lengths and intensity of the emitted as well as the impressed energy, and of the damping factor of the spark to which they have devoted a great deal of attention. By these means long-distance tests are not absolutely necessary, the experimental results showing to a nicety the capabilities of both transmitters and receivers.

The Telefunken system, in its latest form, appears to the casual observer to be merely a survival of the Slaby-Arco arrangement somewhat modified and reduced to greater compactness, but the chief features of the Braun design are not altogether missing, though the high-tension transformer and the artificial earths are no longer in evidence and closer inspection of the instruments shows the genius of Braun in many particulars.

The new company controlling the patents of both of these German inventors, is enabled to choose from a large number of devices, for it now owns over twenty patents, all of which have been issued to the principals who are chiefly responsible for the development of the art in that country. Many of these patents for both methods and apparatus have also, it should be stated, been covered in other countries. One of the patents that is considered especially valuable relates to a transmitting circuit in which the oscillator, consisting of a battery of Leyden jars and a spark-gap, stores up a large amount of energy and then discharges this through the radiating aerial, and in consequence sets up powerful oscillations that are damped but very slightly.

The receptor is likewise provided with a closed resonator circuit syntonized to a frequency of oscillations corresponding to that of the emitted waves, and in this way many of the extraneous disturbances are gotten rid of, while at the same time all the energy radiated by the Leyden-jar system that impinges upon the receiving aerial becomes available for the purpose of breaking down the resistance of the detector.

A patent concerning the syntonization of compound circuits for sending and receiving devices, another looking toward the reduction of losses caused by the spark-gap, which has always been wasteful of energy, and has, therefore, cut down the effective radiating distance, and the Schomlich electrolytic wave detector, which has previously been described in these pages, are considered the most valuable of those controlled by this company.

The superiority of these equipments is in no small measure due

to the fact that the two largest electric companies in Germany are back of the new organization, and have placed at its disposal their entire technical corps, so that any proposition, however difficult, will be subjected to the best analytical minds in the empire.

This company has given special attention to the construction of equipments for military and naval purposes, and of the orders received by them a very large portion refers to instruments for these purposes. The portable apparatus designed for army service has met with considerable favor, and after rigorous tests has been adopted by the German and Russian military authorities. This type of apparatus has also been previously described in this paper, and it will not be necessary again to detail its construction and operation. It is sufficient to state that the transmitter and receptor are mounted on gun carriages, and that the aerial wires are supported by kites or balloons.

Notwithstanding the fact that its selective powers are limited, the military as well as the naval application of the wireless telegraph has proven of wonderful utility and great advantage and, while it is admitted that the enemy may cut in and steal an ordinary message, there is the circumventing alternative of sending the telegram in code.

Considered from another viewpoint, there is much to be gained in the radiation of signals in every direction, for a commanding officer can simultaneously send a message to all of the receiving stations in the field of action.

In connection with the army, it is interesting to note that experiments in the wireless transmission of intelligence have been conducted in combination with the high-speed electric tests on the Berlin-Zossen military railway. Since the regular overhead telegraph lines paralleled the tracks, it was impossible to effect satisfactory electric wave propagation by means of the usual vertical aerials, and so the open oscillator and resonator circuits were suspended in a horizontal plane, and from the first the waves were set free, when they naturally followed the ordinary telegraph wire, and were caught up by the second or horizontal resonator at the opposite end of the line. This remarkable mode of communication has been in constant use ever since its installation during the railway tests in 1903.

Equally interesting is the advance of the wireless telegraph in the maritime service, but its advantages in this peaceful capacity need not be repeated here. It is pointed out by Count Arco that the shores of the North Sea and the Baltic are now joined, so to speak, by an unbroken chain of wireless stations under the control of the Imperial German navy. All telegrams of either a public or private nature are transmitted to distances of 150 kilometers at a cost of 80 pfenning for ten words.

In distinction to the methods employed by the company operating in England and the United States, neither the system used nor the nationality of the vessel is taken into consideration, and it is the sincerest hope of the promoters of the Telefunken system that the latter named countries, the coasts of which are also lined with stations, may yet be operated by their respective navy departments, when an interchange of telegrams may take place between any ship carrying any system of wireless apparatus, and any other ship or shore station, regardless of the make of their equipments.

The definition of tuning and syntonizing seems not to have been elucidated very clearly by the different companies for the benefit of those who may wish to examine into the merits of the competing systems, and in consequence it frequently occurs that the casually interested labor under the erroneous impression that these words indicate that the apparatus is selective.

In the good old days—six or seven years ago—selectivity and syntonization were used synonymously, for it was believed in occult circles of wireless telegraphy that the first was the secret key by which the vaults of the last could be opened, and though it was subsequently shown that the inherent difficulties of earthening the oscillator and resonator prevented the fulfilment of such desirable characteristics, yet syntonic selectivity continued a theory in good standing.

Tuning the circuits of the oscillator, especially where they join a compound system, serves admirably for the utilization of a large percentage of the available energy, and tuning the resonator circuits so that their periods may not oppose the feeble electromotive forces set up in them, is also a very necessary procedure, and when the sending circuits and receiving circuits are tuned for similar wave lengths they are to all intents and purposes syntonized.

But experience has not shown that by this practice they were rendered selective to any great extent. The text of the pamphlet mentioned enumerates many instances where their sets were operated in conjunction with those of other makes, and using presumably waves of other lengths. In one instance, it is cited, a North German Lloyd coast station at Bremerhaven which was fitted with a Slaby-Arco apparatus exchanged telegrams with a Marconi installation on the Kronprinz Wilhelm, 275 kilometers away, and it was ascertained later that messages from each station had been recorded in a clear and decisive manner.

The question most frequently asked when the subject of wireless telegraphy is broached is how far is it possible to send and receive legible messages? One might just as well be asked how far a horse can run. It would depend largely on the horse, then on the roadway, and finally on the driver. Occasionally enormous distances are reported as having been covered by a 1-kw transmitter. Such reports are, however, exceedingly difficult to authenticate, and the conservative estimates published relative to the performance of their apparatus by the German company are certainly a precedent that many of the other companies could follow with profit. As Count Arco intimates, the signaling distance is determined largely by the electrical dimensions of the aerial radiator and the amount of energy with which it is charged. The larger aerials are in the form of inverted pyramids, and require generators of great power to charge them to a point for effective radiation. A large experimental station, fitted up by the company for long-distance tests, compares very favorably with those at Poldhu and South Wellfleet.

This station is located at the power house of the Allgemeine Electricitäts-Gesellschaft at Oberspree, 14 miles from Berlin. Here four great chimneys, each 70 meters in height, serve to sustain the great inverted pyramidal aerial formed of 100 wires, and ending in a cable leading to the engine house.

To energize this great radiating network of wires a power of 15 kw. is required and this is utilized at a pressure of 50,000 volts. The disrupting discharge at this voltage sets up oscillations having a frequency of 900,000 cycles per second. Among the first experiments over long distances, messages were flashed through the vibrant ether for 275 kilometers, where the transmitted energy impinged on the resonating system of the German Marine Funkspruchstation at Marienleuchte on the north coast of the Isle of Fehmarn, and finally this distance was covered with a mast at the receiving station only 35 meters in height, and with an expenditure of only 2 kw. at the sending station.

Then longer distances were tried out, with the result that clear and unmistakable messages were received at the station in Karlskrona, Sweden, 450 kilometers away, with a receiving aerial only 35 meters in height. With these and many other experiments during the past three years, transmitters and receivers of different forms were tested and standardized, and the most powerful are guaranteed to transmit legible telegrams over a distance of 1,200 kilometers.

The fact that the varying conditions of the atmosphere are a disturbing element is one of the reasons the distance of transmission cannot be accurately defined. Operators frequently find that, everything else being apparently equal, the range of signaling may lose or gain in a most inexplicable manner in the course of a remarkably short space of time.

It is evident, therefore, that if there is to be installed a system in which absolute dependence can be put for a given distance, a safety factor of 2 should be included in the specifications. The failure to do this has caused many systems to be condemned. One of the reasons for the success of the Telefunken system has been the recognition of these conditions, which were provided for from the very beginning.

To syntonize two stations has heretofore been a process more or less difficult. To render this more easy of accomplishment, two different devices called ondometers are employed. In one of these, wave lengths from 100 to 1,200 meters may be measured by an apparatus comprising a closed circuit of variable capacity and a vacuum tube for indicating the loops and nodes. In the other, designed by Prof. Slaby, a set of multiplicators is used. In these latter devices, platinum cyanate of barium, which becomes active under the influence of the impressed oscillations, indicates when resonance occurs. By these simple means the wave length of any station may be easily, and for all practical purposes, accurately measured.

One of the especially commendable features of the statement issued by the Telefunken people is their extremely fair attitude toward Marconi and his system. They candidly admit that he

was the first to secure practical results, and that the gigantic difficulties of crossing from the experimental into the commercial zone are due to his genius and indomitable energy. Again, they indicate their conservativeness when they state that their "system must be recognized as, at least, a peer of Marconi's, both in regard to its capabilities and to the independence guaranteed by excellent patents in all civilized countries."

New Electric Garage in Denver.

There has recently been opened in Denver a new garage for the handling and storage of electric automobiles under the management of Mr. Oliver P. Fritchle, an electrochemist of that city. The building is located on Capitol Hill at 1449 Clarkson Street, and is within a stone's throw of East Colfax Avenue, which is the principal artery of pleasure and residential travel in Denver. Designed to care for the electric automobiles of what is perhaps the most attractive residential section of the city, the location of the garage permits the convenient supply of machines to owners at various hours of the day and night, and enables an average run of probably from half a mile to a mile to cover the distance between regular customers and

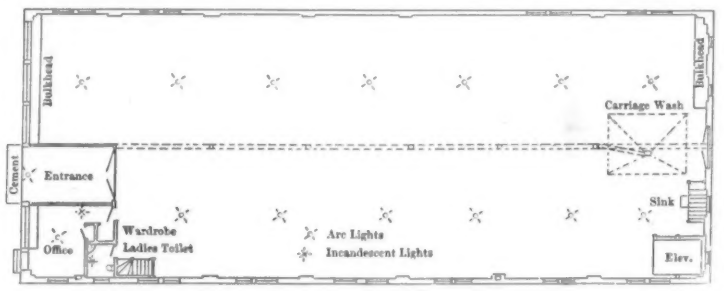


FIG. I.—PLAN OF DENVER GARAGE.

the establishment. A more central location with reference to the class of business handled could hardly have been selected.

The new garage is open day and night and has direct telephone connection with the York office of the Colorado Telephone Company. Its monthly rates for the care of electric automobiles are as follows:

ELECTRIC GARAGE RATES PER MONTH.
(With one full charge of batteries and one delivery per day.)

Small electric runabouts	$25.00
Medium-size electrics	28.00
Electric surreys, broughams and four-passenger automobiles	30.00
Rates for towing machine to station, upward from	1.00
Special rates for dead storage.	
Each extra case or delivery	.25
Each extra charge	.50

Batteries rented by the month.

Batteries guaranteed under written contract for a period of 3 or 5 years at a small maintenance charge per month.

NOTE.—The word "care" covers the following: Keeping the machine cleaned, oiled and looking over all working parts each day. The garage does not carry insurance to cover automobiles stored by it.

The garage building is of brick, one story in height, with a commodious basement. It is 125 ft. long, with a frontage of 50 ft. on Clarkson Street. An artistic cornice surmounts the front elevation and liberal window space is provided. In the front and rear are large double doors for the entrance of automobiles which are run up a short incline in passing from the street into the building. The front door is 10 ft. 8 in. high, 8 ft. 8 in. wide and 2 in. thick, and the rear door is 7 ft. 6 in. high, 8 ft. wide and 2 in. thick. The large "Seeing Denver" automobile easily enters the building through the front door. This automobile work is cared for by the garage in addition to the regular work of private owners.

With the exception of the space occupied by the manager's office and one or two small closets, the storage and charging room runs the entire length of the building. The brick walls are 6 in. thick and on each side of a central row of wooden columns supporting the roof is a clear width of 23 ft. 11 in. from wall to column. The columns are 16 ft. 10 in. apart in the clear and in cross section are 8 in. square.

The floor of the storage room is of wood and a strip of timber 3½ in. square in cross section runs the entire length of the room parallel to the wall on the north and south sides to prevent the charging rheostats from being run down by the automobiles. At the time of the writer's visit to the garage there were installed 15 charging rheostats on the south and 8 on the north side of the building. Each of these rheostats is a Westinghouse grid type, style No. 27,210, and is mounted on four porcelain insulators, raising it about 2 in. above the floor. Three systems of charging are provided, the voltages being 110, 75 and 40, respectively. A switchboard is provided for each system, two being set up on the south side of the room and one on the north. There is also a switchboard on the south side which controls the power supply of the building. The charging switchboards each consist of a single white marble panel 4 ft. high, 22 in. wide and 1¼ in. thick, mounted on two 1¼-in. iron pipes screwed into flanges which in turn are screwed into the floor.

The storage and charging room is brilliantly illuminated by enclosed arc lamps, and presents an attractive appearance at night when the machines are stalled. In one corner is a small work bench for light repairs and on one of the wooden vertical columns are mounted the controlling switches for the lights of the room. Near the west wall is a concrete space with about 150 sq. ft. of drained floor for washing the machines. Near this is a freight elevator used principally for carrying parts of the machines to the basement and back and for the inspection and repair of the under side of the automobiles. By running an automobile over the elevator and supporting it if necessary at the sides of the elevator well, the repair men can stand at full height below the machine instead of being obliged to crawl around on the floor and under the automobile body on hands and knees after the manner of the old days of street car repairing. This scheme of an adjustable pit has already proved to be of great convenience.

There are three charging generators and one driving motor, all being of Westinghouse make and supplied through the Mountain Electric Company, of Denver. The motor is a four-pole, 500-volt, 50-hp shunt machine making 900 r.p.m. It is belted to a countershaft carrying the pulleys, which are in turn belted to the charging generators. These are: One 6-kw, 40-volt, direct-current shunt dynamo, making about 375 r.p.m.; one 11.5-kw, 75-volt, direct-current shunt dynamo, making 700 r.p.m.; one 16.5-kw, 110-volt, direct-current shunt dynamo, making 1,050 r.p.m.

The present capacity of the garage is about 75 machines and as electric runabouts are popular in Denver in view of their simplicity, ease of control by women and children, speed range adapted to city streets, freedom from bad odors, soot, smoke and grease, there is every reason to believe that the new garage is filling a long-felt want and will continue to be more useful as time goes on. It is a great convenience for a family to be spared the trouble of caring for the maintenance and charging of its electric automobile, which is delivered and called for according to any prearranged plan, and is constantly under expert supervision, something which it would sel-

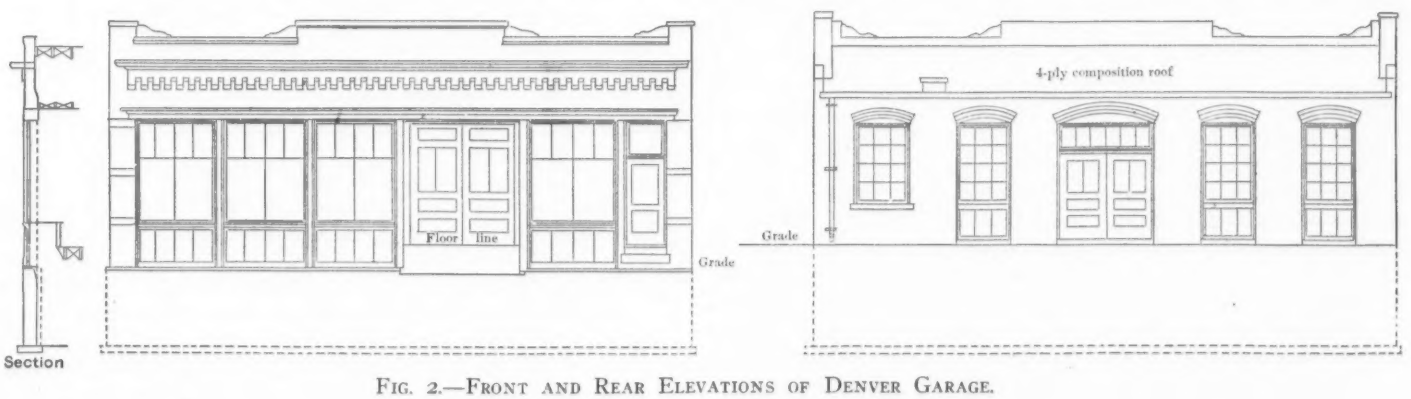


FIG. 2.—FRONT AND REAR ELEVATIONS OF DENVER GARAGE.

dom receive in an average household. Acknowledgments are due to Mr. Fritchle for courtesies extended in the preparation of this description.

Recent Electrochemical Developments.

ELECTRIC FURNACE OPERATION.

It is an old saying that the success of an electrochemical operation on an industrial scale depends largely on keeping initially good conditions permanently good. It is generally easy to arrange everything in such a way that the desired reaction is brought about when the process starts, but it is a far more difficult problem to keep the system in this initial condition without great expense. This is especially the case in electrolytic processes where the tendency of the current is to change the composition of the system. The difficulties are somewhat less aggravated in electric furnace work, yet in this case the problem also deserves careful attention. For an arc furnace with continuous operation the amount of material changed by the action of the arc per unit of time depends upon the electrical conditions of the arc and these again upon the position of the electrodes, if the supply of current from the outside is constant. Further, it is evidently necessary to supply in each moment as much fresh material to the furnace as there has been changed in it by the reaction. Thus, the problem is to adjust both the position of the electrodes and the supply of new material according to the change of electrical energy into useful heat in the furnace.

In a patent recently granted to I. S. Prenner, this regulation is made automatic; the position of the electrodes as well as the speed of supply of fresh material from a screw conveyor are controlled by electric motors operated by the supply current. The mechanism consists of a combination of the motors with ordinary starting resistances, reversing switch and electromagnets for cutting the resistances in and out and for operating the reversing switch. The electrodes penetrate the walls just sufficiently to allow for the maintenance of the arc. The automatic feeding arrangement takes care of the material from the moment it is placed in the crushers and is passed through enclosed passages until it is deposited. The inventor describes the arrangements in detail for a three-phase system.

ELECTROLYTIC PROCESS.

Water is the solvent par excellence on account of its abundance in nature and cheap availability for commercial work. But there is no reason why other solvents should not be used for special purposes. We may mention in parentheses that there are some very active physico-chemists who object to the modern theory of solutions and the electrolytic dissociation theory as being based in a too restricted way on experimental evidence with aqueous solutions: hence, the present activity in the researches with other solvents. For practical work other solvents may be useful in cases where the solvent water prevents the desired reaction. For instance, it is practically impossible to obtain an electrolytic deposit of magnesium or sodium from an aqueous solution, because any metal thus deposited is immediately oxidized by the water. In a recent patent W. Hoopes suggests for this purpose the use of solutions in liquid anhydrous ammonia. He describes especially the production of magnesium by electrolysis of a solution of magnesium chloride in anhydrous ammonia.

LETTER TO THE EDITORS.

The Law of the Electromagnet.

To the Editors of Electrical World and Engineer:

SIRS:—I have read with much interest the several articles on the plunger electromagnet by Mr. Charles R. Underhill, which have recently appeared in your columns. The information therein contained cannot fail to be of value to any one who may desire to design such magnets. It is to be regretted, however, that the author has chosen to depart from electrical engineering practice and to express all dimensions and other quantities in English units, since the results are thereby not only rendered difficult of direct comparison with available results expressed in c.g.s. units, but the heterogenity of English units is apt to mask the operations and lead to error.

On page 882 of your issue for May 13, Mr. Underhill states that "the ampere-turns per square inch of core should never fall below 10,000, in order to keep the core saturated," intimating that the density at this value of magnetomotive force is independent of the length of the core. It is evident that the relation here expressed is quite contrary to the accepted ideas, and the results of the tests reported by Mr. Underhill would seem to indicate that the flux in any given magnetic core material at saturation is proportional to the cross-sectional area, and that the magnetomotive force to produce saturation varies directly with the length of the core, as ordinarily held. Thus, on page 798 (April 29), it is stated that "tests showed that all other conditions remaining constant, the attraction per ampere-turn varies directly with the cross-section of the plunger for equal lengths, whether in the form of a solid rod or a hollow tube." In Fig. 13, on the same page, it is to be observed that with a certain plunger of one square inch cross-sectional area the pull of 25 pounds required 16,000 ampere-turns for a 6-in. length of solenoid, and 30,000 ampere-turns for a 12-in. solenoid; and that while a 9-in. solenoid required 23,000 ampere-turns to give this pull, an 18-in. solenoid required 45,000 ampere-turns.

PHILADELPHIA, PA. CHAS. L. DAWSON.

DIGEST OF CURRENT ELECTRICAL LITERATURE

DYNAMOS, MOTORS AND TRANSFORMERS.

Alternating-Current, Series Motor.—CREEDY.—The conclusion of his illustrated paper. The author describes various experiments which he made to improve the design of his experimental motor. Some conclusions are as follows: For alternating-current, series motors, the armature must be made considerably larger than in present direct-current practice. On account of the very small space occupied by the field winding, a much more compact design of field magnet is possible, thus decreasing both the weight, the reluctance and the iron losses. The iron should be distributed symmetrically about the axis of the main magnetic flux. A motor built in this manner would have good efficiency and high power factor, while the output per pound would probably be even higher than in the motor tested, which at full load gave 9 watts per pound, 100 volts being applied. The author remarks that it will probably prove impossible to obtain a satisfactory test on the series motor by means of one or two observations taken at standstill, as may be done in the case of the induction motor. A brake test will always be necessary. The Hopkinson test is perfectly applicable to the series motor, the power required by such a motor being supplied by another, exactly similar, coupled to it and acting as a brake. The wattless current taken by the machine, however, cannot be so supplied, and thus the generator must supply both the losses and the wattless currents required by both machines.—Lond. *Elec.*, May 5.

Armature Slot Insulation.—HOBART.—The first part of an article giving considerations relating to the design of the armature slot insulation in high-voltage, alternating-current generators. The author has investigated and compared designs of 37 alternators, of various sizes and voltages, as manufactured by firms in different countries. As regards the thickness of the slot insulation from the armature conductors to the iron core, variations of over 100 per cent for a given size and voltage were found. The author gives a curve representing modern practice for the thickness of slot insulation from copper to iron as function of the effective voltage. The article is to be continued.—Lond. *Elec. Rev.*, April 28.

Diseases of Electrical Machinery.—CROCKER AND WHEELER.—In a continuation of their serial, they discuss the heating of field magnets, the heating of bearings and the troubles of noisy operation.—*Am. Elec.*, May.

LIGHTS AND LIGHTING.

Photometric Tests of Street Lamps.—PATERSON.—An account of some measurements made in Teddington where two streets had been

equipped with gas and electric lamps, respectively. The gas lanterns were fitted with single "C" burners, consuming normally from 4 to 4¼ cu. ft. of gas per hour, and having the ordinary type of incandescent mantle. The electric lamps were of the Nernst vertical filament "A" type and Nernst "Luna" type, both taking nominally ½ amp. at 240 volts. If the results are used to calculate the amount of gas and electricity required, respectively, per candle-foot illumination, the following figures are obtained and serve to compare the efficiencies of the two systems:

	Gas.	Electricity.	
		Nernst Luna.	Nernst Vertical.
Power consumption per lamp.	4.12 cu. ft. of gas per hour.	0.12 units per hour.	0.12 units per hour.
Av. illumination measured 7 ft. from post and 5 ft. from ground.	0.25 candle ft.	0.61 candle ft.	0.35 candle ft.
Power required per hour to obtain ½ candle-ft. illumination at a point 7 ft. from post and 5 ft. from ground.	8.2 cu. ft. of gas per hour.	0.098 units per hour.	0.17 units per hour.

The portable apparatus used in the tests is described and illustrated.—Lond. *Elec.*, April 28.

Camp Lighting in South Africa.—An illustrated description of the electric light installation at the military camp at Middleburgh, Transvaal, which is the first camp in South Africa to be equipped throughout with electric lamps. There are six steam-driven, 25-kw, 250-volt, direct-current generators supplying a three-wire system. Upwards of 3,000 incandescent lamps have been installed in the buildings, while for street lighting 55 1-amp. Nernst lamps have been installed.—Lond. *Elec. Rev.*, April 21.

Conduction Losses from Carbon Filaments.—HARTMAN.—A preliminary paper on an experimental investigation of the conduction losses from carbon filaments when heated to incandescence in various gases. Three different gases were used, viz.: hydrogen, nitrogen and carbon dioxide. The numerical results are tabulated.—*Phys. Rev.*, May.

POWER.

Electric Pumps in Mines.—KOCH.—A long illustrated article in which the author first discusses the advantages of electric pumps in mines. The polyphase induction motor is considered to be the most suitable. The author then discusses the comparative advantages of plunger pumps and high-pressure centrifugal pumps. With respect to efficiency a good plunger pump, if driven directly by an electric motor, is superior to a high-pressure centrifugal pump, and this is the more so the greater the height to which the water is raised and the smaller the amount of water for the same power. For raising from three to five cubic meters per minute to a height of 400 or 600 meters or more, directly-coupled plunger pumps have an efficiency 15 per cent higher than high-pressure centrifugal pumps. If, however, the plunger pump is not directly coupled, but a gearing is used, its inherent advantages are counterbalanced. The essential advantages of high-pressure centrifugal pumps are low cost, small space and the small amount of attendance which they require. In summing up, the author says that in all cases in which high economy is essential, the plunger pump should be used, while in such cases a high-pressure centrifugal pump might be installed as an inexpensive reserve machine. On the other hand, whenever low first cost, low cost of foundations and installation, easy transport and small attendance are important, the high-pressure centrifugal pump is preferable to the plunger pump. The author describes various types of pumps made by German companies and then notices a recent installation of a colliery near Siegen. In this case the amount of water to be raised is small, but the height is considerable. Since economical and cheap operation is essential, a plunger pump was installed. It is coupled to a 90-hp, 2,000-volt, 25-cycle, three-phase induction motor running at 80 r.p.m. The three-phase currents are supplied from a steam-driven generator.—*Elek. Zeit.*, May 4.

Electric Cranes for Very Heavy Lifts.—E. K. SCOTT.—To handle heavy guns for warships or complete trucks of coal, electric cranes, if employed at all, must be used in conjunction with a storage battery. Since the conditions are somewhat similar to those on electric railways running only a very few large cars, and since for such work the reversible booster has been successfully used, the author recommends its use also for heavy crane work. The reversible booster has the great advantage of enabling the main dynamo to work at a steady load, sending current into the battery or into the outside circuit, just as may be required, the action being entirely automatic. The dynamo described gives 100 amp. at 315 volts, while the cranes on occasion may take as much as 350 amp. When the cranes are making a heavy lift, the balance of the current of 250 amp. is supplied momentarily by the storage battery. When charging, the booster adds about 15 volts to the dynamo pressure, and when discharging, the total magnetomotive force due to the series coils completely overcomes the magnetomotive force of the shunt coils. The magnetism in the field cores is thus reversed, and about 20 volts are added to the battery discharge e.m.f., so that the pressure at the cranes is kept about constant.—Lond. *Elec. Rev.*, March 31.

Retort Charging Machines.—An illustrated description of electrical machines for charging and discharging gas retorts.—Lond. *Elec. Rev.*, April 7.

Suction Gas.—MATHOT.—An illustrated article on the design and operation of suction gas producers. The author gives the general principles covering their design and applying equally well to those intended to supply motors of 10 hp as well as those for motors of 200 to 250 hp.—*Eng'ing Mag.*, May.

TRACTION.

Electric Traction.—YOUNG, TREMONTANI, GERARD.—Abstracts of three papers presented before the International Railway Congress. (A paper by Dubois was noted in our last issue, page 926.) The paper of Young gives statistical data on electric traction in America. Tremontani discusses the relative advantages and disadvantages of steam and electric traction. He says that the application of electricity to the traction of railway trains is now a necessity and requires to be seriously investigated and applied, particularly in the case of those countries—like Italy and Switzerland—where coal is dear, and where, on the other hand, there are abundant natural sources of supply of energy. The continuous-current system has been thoroughly tried, and its use in traction on railways has demonstrated its excellent qualities of large range of load (great acceleration) and elasticity; it is to be preferred where the railway has a heavy passenger and goods traffic, and where a frequent and quick service is required. The three-phase current system is complicated, and has the disadvantage of loss of a considerable amount of energy in the resistances when starting. A great movement in favor of the single-phase system has taken place during the last few years, and it may be definitely stated that in it will be found the solution of the problem for light railways and for those lines which run into towns where the single-phase motor can also utilize the continuous-current supply. From the service point of view it is necessary that the existing trains which start at intervals of several hours should be replaced by light trains running at short intervals. This is only possible with electric traction. The report of Gerard is divided into two sections. The first deals with the electrification of steam railways in Great Britain and Belgium. In England, on the lines where electric working is now in operation, the electrification is attended with an increase in the number of trains and, consequently, in the facilities offered to passengers. The results obtained show that this is followed by an immediate increase in the number of passengers and in the receipts, with a material decrease in the cost per train-mile, with an increase in speed, a considerable increase in comfort, particularly in tunnels, and that this latter forms an attraction which has a serious influence on the number of passengers carried. The danger to people who have to move about in the neighborhood of the third rail, and the dangers which result from short-circuits, can easily be avoided. The second portion of Gerard's report deals with the use of electric automobile cars. In so far as it is a question of trains at rare intervals, on sections where there is no advantage in increasing the number of trains, automobile cars make it possible to realize some economy as compared with trains hauled by steam locomotives; electric automobile cars have the advantage that the speed can easily and readily be controlled with great simplicity and certainty from either end of the car without any necessity for turning the car around. Experience will show whether accumulators or dynamos driven by petrol motors give the better results.—*St. R'y Jour.*, May 13.

Armature Drying and Dipping in Tramway Repair Shops.—An article in which it is said that, for obtaining a maximum drying effect with a minimum rise of temperature, a vacuum chamber may be profitably employed in tramway repair shops. This may also be used in connection with impregnating the armature with a suitable insulating varnish. The latter process, however, is not recommended in the case of a new form-wound armature. But when an armature has been running for a considerable time and the insulation of all the coils has naturally depreciated, it would probably be necessary to discard the coils should they have to be lifted. In this condition, impregnation can be carried out with greatest advantage, and the life be lengthened. To obtain good results the varnish must find its way into all cracks and crevices and mere painting and dipping will not achieve this, since air pockets are formed. To remove the same, the vacuum chamber is employed. There is given a diagram showing an apparatus which fulfills the double purpose of drying and dipping, and the method of operating in both cases is described.—Lond. *Elec. Times,* April 6.

Paris.—REYVAL.—A profusely illustrated article on the electric equipment of the Metropolitan Railway in Paris. It is said that, during the first four years, modifications of the equipment have been going on, but that this period is now over and the operation has now reached a settled condition. Direct current at 500 volts is used on a third-rail system. Three-phase alternating current is generated in various power plants, and transmitted to various sub-stations along the line.—*L'Eclairage Elec.,* April 22.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

End Cell Switch for Storage Batteries.—LIEBENOW.—An illustrated paper read before the Berlin Electrical Society. The author describes a new end-cell switch, the object being to reduce as much as possible the number of copper conductors from the switch to the end cells, in order to reduce the cost. The switch consists of two parts, which are mechanically coupled together. The two switches act on the two different ends of the battery, as shown in Fig. 1. *Z*

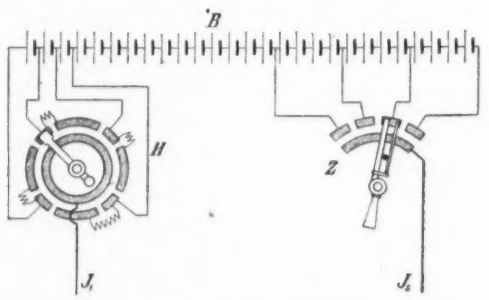


FIG. 1.—END-CELL SWITCH.

represents the main switch, which is connected by four conductors to three groups of end cells, each group comprising four cells. *H* is the auxiliary switch, which is connected by four conductors to three single cells at the other end of the battery, *B*. The line is indicated by $J_1 J_2$. In order to change the e.m.f. by two volts for each step of the switch, the operation is as follows: Suppose all three cells at the left end of the battery are in circuit, then switch *H* is moved step by step, so that at each of the three steps one of the three cells at the left hand is disconnected. Then both switches, *H* and *Z*, are simultaneously moved, so that by means of *Z* four cells are disconnected from the circuit, while by means of *H* three cells are inserted in it. The mechanical coupling of the two switches, *H* and *Z*, is not described. In the discussion which followed the fear was expressed that such a coupling might be difficult. This was denied by the author. A large part of the paper is devoted to formulas for general arrangements of this kind.—*Elek. Zeit.,* May 4.

Bimetallic Rheostats.—PUNGA.—A description of a construction of rheostats devised by Hobart and Punga. Two metals are used: the chief material for storing up the heat is iron, but the current is conducted almost entirely by a copper winding, which is in close metallic contact with the iron wire. The latter is able to absorb the heat from the copper very quickly; in fact, tests have shown that the copper winding can be designed quite independently of thermal considerations; the cross-section can be chosen so small that the wire would fuse instantaneously if suspended in free air. The current density employed in a copper wire of 0.27 mm. was 250 amp. per sq. mm., or 150,000 amp. per sq. in., and after 120 seconds the temperature of the wire was only just high enough to soften common solder. By this means it is possible to obtain a rheostat in which the heating is taken care of by the iron wire, and the exact resistance is obtained by choosing the copper of different cross-section. A rheostat may be constructed in form of coils or a honeycomb design may be chosen as shown in Fig. 2. The latter con-

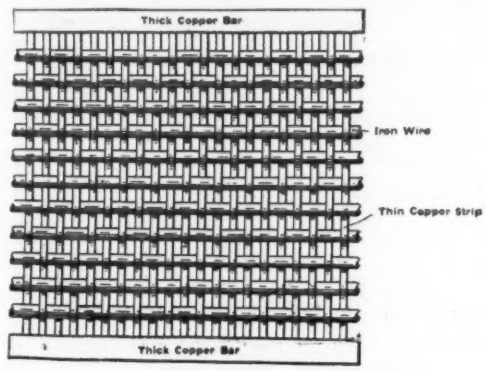


FIG. 2.—BIMETALLIC RHEOSTAT.

struction can be used for almost any current.—Lond. *Elec. Rev.,* March 31.

ELECTROPHYSICS AND MAGNETISM.

Short Spark Discharges.—KINSLEY.—An account of an experimental investigation of very short spark discharges. Some of the results drawn from the experiments are as follows: The carrier of the electric discharge is unchanged between 450 $\mu\mu$ and 3 $\mu\mu$. Throughout this range the discharge occurs along the shortest path between the two surfaces. It seems that the carriers of the electric discharge come neither from the gas in the chamber nor from the metal of the electrodes. The mechanism of discharge seems to be the same for short as well as for long sparks. In an appendix is described an interesting experiment which shows that coherence is caused by the formation of a metallic bridge between the surfaces. If a spark discharge is passed between two surfaces which have been separated to a distance of, say, 100 $\mu\mu$, they will cohere. If now the surfaces are slowly separated from each other, the resistance will very gradually increase, indicating that a metallic bridge still exists after the surfaces have been separated to a distance of nearly 800 $\mu\mu$.—*Phil. Mag.,* May.

Heat Effect of Gamma Rays from Radium.—RUTHERFORD AND BARNES.—Paschen has recently found that the heating effect of gamma rays is greater than that of alpha rays; this is in agreement with his view that the gamma rays consist of negatively charged particles (electrons) projected with a velocity exceedingly close to the velocity of light. The present authors have made very careful determinations of the heat effect of the different kinds of rays, and conclude that the gamma rays contribute but a very small fraction of the total heat emission of radium, and that the apparent increase observed by Paschen must be explained by other causes. The small heating effect of the beta and gamma rays compared with that due to the alpha rays is in agreement with calculation based on the relative amount of ionization produced by the rays. The heating effect of radium is due largely to the bombardment by the alpha particles expelled from its own mass on the containing vessel.—*Phil. Mag.,* May.

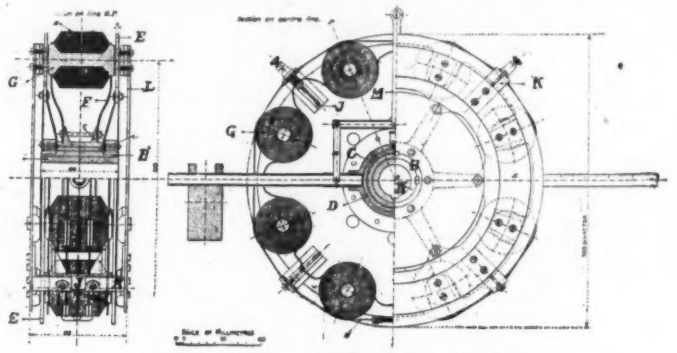
Crystallization of Bismuth in the Magnetic Field.—LEDUC.—An account of experiments in which the author filled several glass bulbs with fused bismuth and let it solidify between the poles of a Faraday electromagnet, giving a field of some 5,000 units. The crystals then arranged themselves so that their greatest permeability was in the direction of the field. On suspending the bulbs afterwards in the same field, they take up the position they held during crystallization. The author expects similar results to attend the crystallization of magnetite or pyrrhotine in a magnetic field.—Lond. *Elec.,* April 28; from *Comptes Rendus,* April 10.

Harmonic Analysis.—THOMPSON.—A description of a new method for determining the numerical coefficients of the Fourier series into which a periodic wave can be dissolved. The procedure is essentially based on an elaborate method of analysis by Runge, which, however, is greatly simplified by the consideration that all the even terms in the series are absent as far as the study of alternating

currents is concerned. The procedure is described and applied to several numerical examples.—Lond. *Elec.*, May 5.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Eddy-Current Brake for Testing Motors.—MORRIS AND LISTER.—A description of an eddy-current brake designed by the authors. It is intended to be mounted on the motor shaft in place of the ordinary pulley. Its construction is shown in Figs. 3 and 4. The



FIGS. 3 AND 4.—EDDY-CURRENT BRAKE.

fixed portion of the brake is carried by the revolving system, and though there is friction at the brushes, this small load is duly represented as torque on the brake lever. A similar argument applies to the air friction. Mechanical and electrical symmetry are insured by the use of two copper discs, one revolving on either side of the magnetizing coils. This doubles the capacity of the brake for a given diameter, and, incidentally, renders it completely astatic. A multipolar design is employed, since in this case the weight is less than that for a two-polar design. Fig. 5 shows the brake mounted

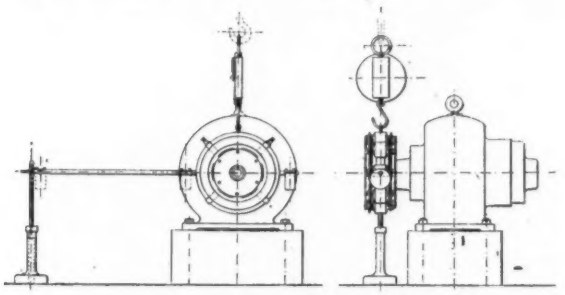


FIG. 5.—EDDY-CURRENT BRAKE.

on the spindle of an electric motor, and indicates the manner in which the pressure on the motor bearing may be adjusted. The brake is provided with a link suspension, so that an upward pull gives rise to no twisting moment. This suspension is attached to a spring balance, which can conveniently be carried by the hook of the crane or blocks serving the testing bed. By means of the lifting gear the pressure on the bearing may be reduced to nothing, or it can be given any desired value. Bearing friction in motors may be tested with this brake with an accuracy not hitherto possible. In cases where a lifting gear is not available, the suspension and balance could be carried by a special frame, provided with screw and hand wheel. For ordinary testing the whole brake can very well be carried on the motor spindle without suspension. The two revolving discs on both sides are made of high conductivity hard-rolled copper. They are supported by a thin steel plate and steel arms on the outer and inner sides, respectively, each hub being keyed to the bush, *B*. Between these discs is the casting, *C*, which is fitted with a gunmetal bush, *D*, bored to suit the bush, *B*. Into this casting are screwed two tubes, the shorter carrying the counterpoise and the longer constituting the lever arm. This arm is marked with a scale of feet divided into tenths and hundredths, the maximum leverage being 8 ft. The brass plates, *F*, are bolted to the casting, *C*, and carry at their circumference the magnet coils, *G*. These coils, which are eight in number, are securely held in position by steel wires. Each consists of a wrought-iron core wound with 1,400 turns of No. 20 S. C. C. copper wire. The resistance of each coil is 5.1 ohms when cold. There is a ventilating duct at the middle of the coil. The aluminum castings, *J*, act as distance pieces, the two upper ones being fitted with insulated terminals. Secured to these castings by set-pins are the aluminum castings, *K*, which carry the external yoke rings, *L*. A slotted hole in the castings, *K*, allows the length of the external air-gap to be adjusted. The length of the internal air-gap is fixed, and, in consequence of the rigidity and smooth running, it can be kept short. Steel bushes, *A*, are turned to suit the inside of bush *B*, into which they are keyed. They are bored out to various sizes to suit the spindles of the motors, which have to be tested. The suspension links, *M*, are fitted to the graduated lever and to the counterpoise lever at equal distances from the center. Accurately adjusted sliding weights of 2½ pounds, 5 pounds, 7½ pounds and 10 pounds, are used. After completion, the brake was supported on a central knife edge, and the counterpoise lever was loaded until an accurate balance was obtained. The results of various tests are described. The article is to be concluded.—Lond. *Elec.*, May 5.

Apparatus for Magnetic Measurements.—GUMLICH AND ROSE.—An illustrated article giving the results of comparative tests made in the Reichsanstalt with three types of apparatus, devised by Epstein, Moellinger and Richter, respectively, for magnetic tests of iron. The apparatus of Epstein gives the correct value of the total iron loss at 50 periods, but the value for the hysteresis loss is about three per cent too high, so that the eddy-current loss is also to be corrected. The apparatus of Richter gives the hysteresis loss correctly, but gives the total loss for 50 periods too high by about three per cent; a corresponding correction is, therefore, to be applied to the eddy-current loss. The readings of the Moellinger ring are identical with those of a directly wound ring of the same dimensions; on account of the lack of uniformity of the magnetization it is recommended to add about two per cent to the loss figure.—*Elek. Zeit.*, April 27.

Units.—ROBERTSON.—A communication regretting the sentiment which exists toward the c.g.s. system, which is said to have no standards at all, but is referred to the standards of the "kilogram-meter-second-ohm system." The latter is said to be the only one which has been legalized. "It only causes needless confusion and trouble to have two systems of units. Hence, either the c.g.s. or the k.m.s.o. system must in time give way to the other. It will be impossible to alter the legal units without much weightier reasons than can at present be shown in favor of the c.g.s. system, and, moreover, it is much easier for scientists, who understand these matters, to change their system, than for the general public to do so. Scientists ought, therefore, to recognize that the practical system is already a *fait accompli*, and gradually fall into line with it, using, of course, multiples and submultiples with the corresponding prefix when desirable."—Lond. *Elec.*, April 28.

System of Units with Two Fundamentals.—HAAS.—A sketch of a system of units which eliminates mass and contains time only in connection with velocity. The system leads to simple and rational formulas for the chief electric and magnetic quantities. The dimensions of mass are derived from Newton's law: $M L T^{-2} = M M L^{-2}$, which if the gravitational constant is unity, gives $M = L^3 T^{-2}$, or $L V^2$ if V is velocity. Quantity of electricity and quantity of magnetism are given the same dimensions as mass. Energy has then the formula $L V^4$, current strength is V^3, force is V^4 and power is V^5. Resistance is V^{-1} and resistivity $L V^{-1}$, while capacity is simply L^{-1}. Potential, whether due to gravitational, electric or magnetic force, is simply V^2, and magnetic moment is $V^2 L$. The mechanical units may be obtained by substituting in the usual formulas $L V^1$ for T and $L V^2$ for M. No fractional indices can thus arise. The electric units above are all measured electrostatically, but if the velocity of light is taken as the unit of velocity the difference between the two electric systems disappears. One would suppose, however, that no rational system can be arrived at by making the dimensions of magnetic pole and electric quantity the same.—Lond. *Elec.*, April 14; from *Phys. Zeit.*, April 1.

Measuring the Tension of Overhead Lines.—An illustrated translation of a recent German article on a dynamometer for measuring the tension in overhead lines after erection.—Lond. *Elec. Rev.*, April 21.

Resistance Thermometers.—CAMPBELL.—His British Phys. Soc. paper in full, an abstract of which was recently noticed in the Digest, on direct-reading resistance thermometers and on composite thermocouples.—*Phil. Mag.*, May.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Submarine Cable Construction.—An editorial on a recent patent of Hardie and Sir Oliver Lodge. The patent describes methods

for the increase of inductance and also of the leakage within certain limits. Instead of the iron wire around the copper, used in experimental cables constructed for the German Government, the patentees propose two alternatives: either a wire of rectangular section, instead of circular, wound around the copper conductor or a series of iron washers threaded tightly over the conductor. Heaviside had formerly stated that if the iron is in actual and continuous contact with the copper, the skin effect would destroy the benefit that might otherwise be derived. It is, therefore, now suggested to place a thin layer of insulation (thick varnish) between copper and iron, and to employ the washers in preference to the continuous spiral of rectangular wire. To lower the insulation resistance several methods are suggested. "One way of doing this is by incorporating a fine powder, say a suitable form of carbon, such as plumbago, in the insulating material"; another way is to use a thin layer having a high specific insulation and a thicker layer with a lower insulation. A third method, intended to supplement the other methods described, is to introduce high-resistance spirals reaching from core conductor to sheath, at regular intervals. It is also suggested that for deep-sea cables the outer iron armoring should be dispensed with, the desirable mechanical strength being obtained by increasing the thickness of the copper conductor if necessary, and that in place of this the outer insulating cover should be increased in radial thickness to as great an extent as is permissible in practice.—Lond. *Elec.*, May 5.

Moore Vacuum Tube Light.

The accompanying illustrations show some recent applications of the system of vacuum tube lighting invented by Mr. D. McFarlan Moore. This system in general consists in placing all of the distinctly electrical apparatus in a single steel casing, or box-like enclosure, as shown in Fig. 1. A low-potential circuit supplies the simple apparatus within the box with electric current. From the box extend two glass tubes, which are made to form a loop of glass tubing. This loop of glass tubing radiates a soft, white light from every part of its surface, and can vary in length from a few inches to several hundred feet, and the diameter of the tube can be changed at will, as well as the form of the loop.

The tubes are exhausted of air, but contain a very small quantity of a special gas Mr. Moore has discovered, which conducts the electricity whereby light is produced. In some cases the electricity

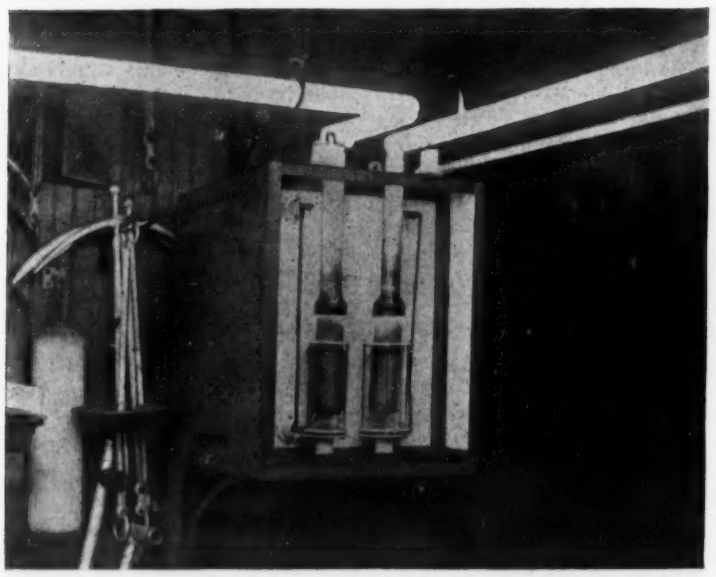


FIG. 1.—INTERIOR OF TERMINAL BOX.

passes from the service wires to the gas by external electrodes, due to electrostatic induction. In others the electricity passes to the gas through the intermediary of conducting electrodes placed in the interior of the ends of the glass tubes, this latter method being the one usually adopted.

When these tubes are made in a form, or of a length, too great to be portable, the entire apparatus is constructed at the factory and erected wherever its light is to be used. But where a very large area is to be illuminated by a single tube, it is most expedient, in order to obtain the effect desired to construct the tubes on the premises. This is done by placing tubes 10 ft. in length end-on-end in their desired positions; for example, on the wall of a room, near where the picture moulding usually is located, or on the ceiling, or suspended from the ceiling by suitable fixture supports. These lengths of tubing are then hermetically sealed together, by means of a new gas fire especially invented for the purpose. Mr. Moore has also worked out the other necessary tools for doing this work rapidly, cheaply and in a manner that is thoroughly practical. After such a long glass tube is once installed it is claimed it will last indefinitely, and can be considered a fixture on the premises, just as the gas and water pipes are. The only depreciation so far as the glass tube is concerned would be its ends within the terminal box, and some of these in commercial operation have already shown remarkably long

FIG. 2.—HARDWARE STORE ILLUMINATED BY A MOORE TUBE.

life and the prospects are good for still further increasing the length of time between renewals of either the gas or the terminals, either one of which is stated to be a simple and inexpensive process. The steel terminal boxes contain, besides the tube's electrodes, a static transformer, which steps up the voltage in accordance with the length and size of the tube operated from a given box. The only wires extending into or from these boxes are the ordinary low-potential service wires.

Mr. Max Loewenthal, in a report, has given the results of tests and measurements on one of these tubes (Fig. 2), which was 1¾ in. in diameter and 155 ft. long, outside of its terminal box, when it was operating at a brilliancy of 4.2 candles per foot. The terminal box in this installation was furnished with current at a pressure of 238 volts from 60-cycle, alternating-current street mains, as measured by a standard Weston alternating-direct-current voltmeter. The total watts taken from the street mains while the tube was lighted, as indicated by a standard Weston wattmeter, were 2,440, and the transformer losses were 390; therefore, the watts used by the tube were 2,050. An accurate measurement of the candle-power was made with a special and accurately designed Bunsen photometer, 5 in. sq. and 3 ft. between light sources. Through one end of this photometer the vacuum tube passed, so that exactly 3 in. of its length was exposed to the inside of the photometer box. At the other end of the photometer there was a certified standard German Reichsanstalt hefner amyl-acetate lamp. The total hefners of the tube, therefore, were 744, which, divided into the total watts on the tube, shows that the watts per hefner were 2.7, which corresponds to 3 watts per candle-power. Other tests showed that this efficiency remained constant over a wide range of brilliancy. The tube is claimed to have the very great advantage over incandescent lamps in that the diffusion of its light is far better, the light in fact closely imitating diffused daylight.

In another installation which has been in successful commercial operation for over a year, the tube receives its power initially from the direct-current street mains, and there is installed, besides the usual terminal box, a motor-generator which is located in the basement of the building and which changes the direct into suitable alternating current for the tube. This tube is provided with the external variety of electrodes and is operating at 5 cp per foot. It is used to

illuminate high-grade photographs and oil paintings, which appear under it exactly as they do in daylight.

Another installation is used as an "artificial skylight" (Fig. 3).

FIG. 3.—ARTIFICIAL SKYLIGHT.

It differs from the long tube installations just described in that it was entirely constructed at the factory, and simply attached to the ceiling of the premises. This tube is bent back and forth over the entire surface of a window-like box 4 ft. wide by 5 ft. 8 in. long. This piece of apparatus has been in commercial use over a year and a half, and has been operated about 2,500 hours. Various measurements show that there has been no change in its condition, and

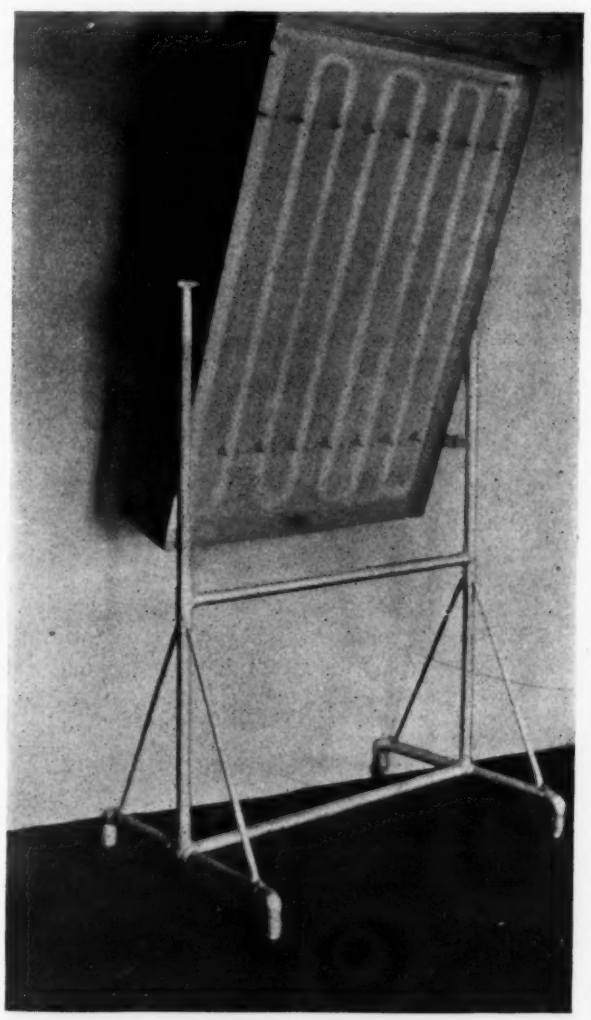


FIG. 4.—PHOTOGRAPHIC WINDOW.

seem to indicate that it will continue to last an indefinite number of hours. A modified form of this skylight tube (Fig. 4) is being very successfully used by a number of photographers for obtaining what are claimed to be the best portraits ever made by artificial light—their quality being equal to that from daylight. One of these photographic windows has already a recorded life of 1,800 hours and it is

FIG. 5.—MOORE TUBE SIGN.

operating at 7 cp per linear foot of 1¼-in. tubing. The owner of this particular window has tried every other form of light and

FIG. 6.—MOORE TUBE AT ENTRANCE TO MARCEAU STUDIO.

states that there is no other that can be compared with it. One of its most marked advantages is that, while being posed the subject

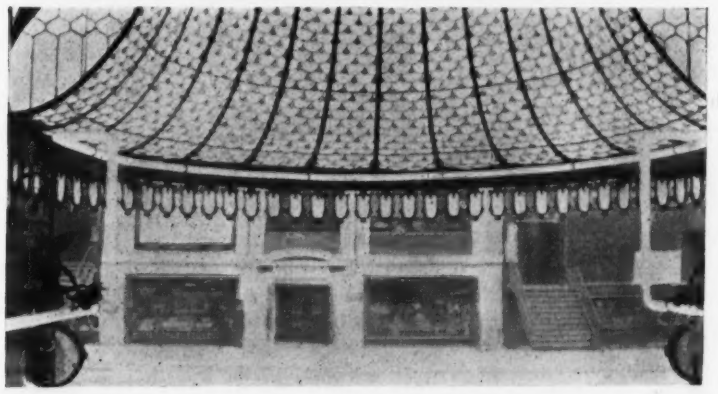


FIG. 7.—MOORE TUBE AT ENTRANCE TO SARONY STUDIO.

appears exactly as he would under daylight conditions. As a proof that this is the first light to actually reproduce daylight color values, it is stated that another art dealer, during the dark days of the holiday season, had his pastelle artists actually mixing their colors

under it. Among the many other special uses for which this new form of lighting is adapted is for advertising. Fig. 5 shows a script sign made by bending a Moore tube into the form of letters.

The installation of Fig. 2, which has previously been referred to, is in a hardware store in Newark, N. J. The "skylight" of Fig. 3

FIG. 8.—OFFICE ILLUMINATED BY MOORE TUBE.

is installed in the Sarony photographic studio, New York. Fig. 6 shows the Moore tube applied to the illumination of the entrance to the Marceau photographic studio, New York, and Fig. 7 is a similar installation at the entrance to the Sarony studio. Fig. 8 is an installation at 1381 Broadway, New York.

Testing Department of the General Electric Company.

The work of the General Electric Company's testing department consists in testing, at a regular stage of the manufacture, every piece of apparatus built by the company at its Lynn and Schenectady works, no matter how large it may be nor how much power it may take. The department erects and operates temporarily each generator, motor, controller, transformer, etc., for reproducing the conditions of the final installation and applying tests much more severe than the aparatus is likely to undergo in regular service. For example, a large turbine-generator, of a type developed for most economical performance under prescribed conditions, is erected with the necessary steam connections, electrical connections and auxiliaries, and given a long enough run under expert observation to develop any difficulties peculiar to its future installation, so that their remedy may be applied before the unit is delivered to its purchaser. The facilities at the works can accommodate nearly every machine built, although the department sometimes sends its men to the place of installation.

The primary object of the organization is to insure a thoroughly satisfactory product. At the same time a vast fund of electrical and mechanical data has been accumulated in complete records of all tests covering a period of nearly twenty years, and these records are on of the company's most valuable assets in the preparation of new designs. At the Schenectady plant alone the department employs nearly 600 men, and passes upon a production of upward of 60,000 kw. a month in electrical apparatus giving due attention to each individual machine.

Under a general foreman and his assistants the testing force at Schenectady is divided into a number of sections, each with a head who is directly responsible for the work done by his group of men. About three-quarters of the men who make up the actual force are technical graduates, representing from time to time nearly every civilized country in the world. The work is handled by squads composed of "regular men," who have had extensive practical experience in the company, assisted by the newer recruits. The factory product, for convenience and economy in testing, is divided into the following groups:

Large machines assembled and tested in building No. 16, including rotary converters, large alternators and motor-generators of 1,000 kw and over. Large slow and moderate speed generators and motors. Small slow and moderate speed generators and motors. Large generators assembled and tested in building No. 11. Induction motors. Transformers, feeder regulators, reactive coils, compensators, etc. Direct-connected generator sets ("marine test"). Motors for warships, etc. ("Government test"). Railway motors. Special testing. Work on the experimental railway. Turbine-generators and accessories assembled and tested in buildings Nos. 16, 20 and 85. Routine testing in building No. 23, including controllers, rheostats, fuses, circuit-breakers, switches, oil switches, searchlights, etc.

The work is handled at "testing stands" conveniently located in various buildings of the factory. These testing stands are equipped with switchboards to which alternating and direct current and power in all commercial voltages is brought by heavy independent cables from the two power stations of the works. A large number of electrical measuring instruments, frequently and systematically calibrated by the Standardizing Laboratory, is used by the department. Iron floor plate and adjustable foundation arrangements facilitate quick work in erecting the machines for test. Water rheostats are conveniently located for absorbing the power of generators under test, although time and energy are often saved by testing machines in pairs by the "pumping back" method.

When in the course of manufacture at the Schenectady works a machine has arrived at the testing stage, it is delivered by the inter-factory tramways and traveling cranes at a suitable testing stand. If the machine to be tested is a rotary converter, for example, the squad assigned to it proceeds to assemble its fittings and connect it up for test. Bearings, commutator and brushes, instrument connections, main and auxiliary wiring on alternating and direct-current sides, including excitation and load connections, etc., are all looked after quickly but methodically. When all is in readiness the machine is started up and run at various outputs, including its rated full load and overloads, under conditions identical with those of its future use.

TESTING FLOOR AT SCHENECTADY.

Systematic and accurate electrical observations, readings of speed, temperature rise, etc., are made and the performance of the machine as a whole carefully watched. The active duties of each man in the testing squad keep him wide awake at all times to discover any defects of construction or operation in the machine under test, and he takes naturally the point of view of the purchaser or ultimate

user of the apparatus. On the other hand, the behavior of the machine under test is supervised during its run by the engineers who have designed it. In order to "get through the testing department" a machine must not only perform its commercial guarantees, which is a matter of satisfying the immediate customer, but must also satisfy the more exacting expectations of the engineers who have been responsible for its design.

Tests so conducted make for a pretty thorough knowledge of the machine as it is going to behave in its purchaser's plant. The education of men is of equal importance on the engineering side. In the testing squad every hour is full of instructive experience for every man, and practical observation at close range, the stimulus of team work and the gradually increasing responsibilities tend to develop his best engineering abilities. New features constantly present themselves, both in construction and conditions of operation, which try his resources by calling for the prompt extemporizing of special test methods. Such experience is the best graduate course in electrical engineering in the world, and the testing department is thus a great source from which are drawn men who ultimately fill important engineering, commercial and executive positions in the service of the company and of its customers.

The testing department has, of course, grown as the General Electric Company's business has increased. During the year 1895 the department at Schenectady utilized space in two buildings. At the present time it utilizes an area of over 110,000 sq. ft., in seven buildings of the Schenectady Works, and possesses vastly improved facilities.

Electric Pumping Station of the Schenectady Water Works.

The new electric pumping plant of the Schenectady Water Works is located at Rotterdam, N. Y., about three miles west of Schenectady, adjacent to the old plant, which is equipped with two vertical steam pumps of 6,000,000 gallons daily capacity each. The new electric station has a rated capacity of 24,000,000 gallons in twenty-four hours against a head of 110 pounds per sq. in.—twice the output of the old steam plant—and it occupies a very much smaller ground space.

The pumps are 18-in., two-stage, vertical shaft turbine type, built by Henry R. Worthington. They consist of an outside casing, inside of which is located a set of fixed diffusion rings and vanes, and a rotating runner or "impeller." The water enters the top of the casing at the center of the impeller, and is thrown out through the diffusion vanes into the discharge chamber. The vanes are so curved as to transform the kinetic energy, imparted to the water by the pump, into static pressure with minimum loss. The pumps are installed in the 21-ft. pit of the station, as shown in Fig. 1, and draw the water through a 42-in. suction pipe from two circular wells 42 ft. and 35 ft. deep and 50 ft. in diameter.

The vertical shafts of the two main pumps extend to the station floor and are direct-coupled to the rotors of two 800-hp. (rated), 550-volt, 40-cycle, three-phase, General Electric squirrel-cage induction motors, installed on the station floor. The rated speed of the motors is 800 r.p.m., and their lubrication, a very important matter at such high speed, is effected by forcing oil, at a pressure of about 100 pounds, under the thrust bearing, which is arranged in the horizontal bearing shield on top of the motor.

Two separate and independent 10,000-volt transmission lines are provided, running from the Dock Street sub-station of the Schenectady Illuminating Company, which furnishes the city of Schenectady with power and receives its current from the water power stations at Mechanicsville and Spiers Falls. The lines are also connected to the power stations of the General Electric Works, as a further source of power. The lines are controlled at both ends by automatic oil switches, and protected at both ends by lightning arresters. The oil switches are so adjusted that a heavy overload on the pump motors will trip the switches at the pumping station end of the line only, so that the pump service can be resumed immediately by closing these switches. On the other hand, a dangerous overload, or a short-circuit on the line, will trip the generating station switches also, thus protecting line and apparatus against injury.

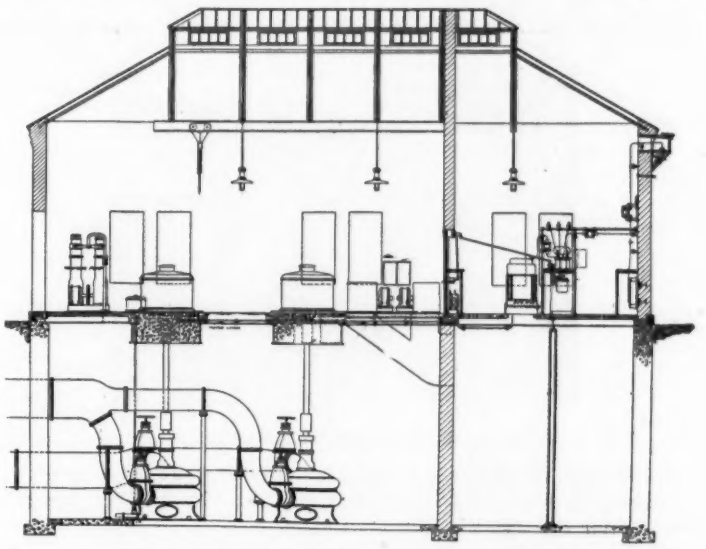


FIG. 1.—SECTIONAL VIEW OF PUMPING STATION.

At the pumping station the high-tension current is stepped down to 550 volts by two banks of three 250-kw, single-phase air blast transformers. The transformer secondaries are provided with taps, wired to double-throw switches, for starting the 800-hp main pump motors at quarter and half voltage in order to avoid the heavy rush of current that would be caused if the motors were started at full voltage. There is also installed a 150-kw, 10,500-9,500, 2,400-2,200-volt lighting transformer, which supplies current to the village and the railway station nearby. The necessary air blast is supplied by two independent induction motor-driven blowers installed on the station floor.

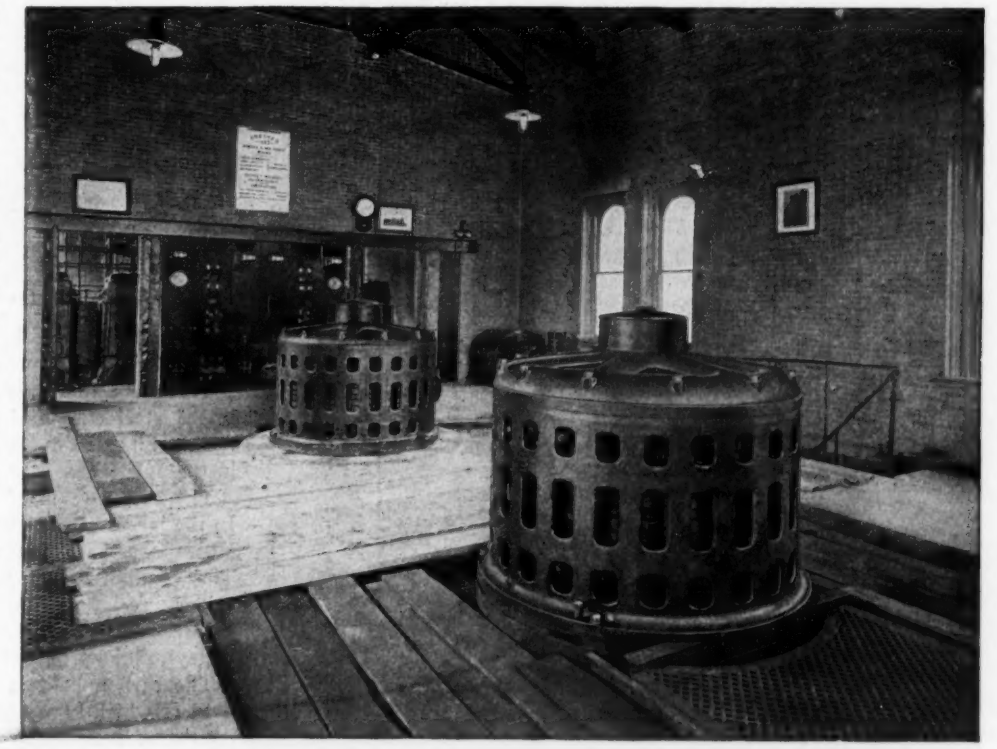


FIG. 2.—VIEW SHOWING THE INDUCTION MOTORS WHICH DRIVE THE PUMPS.

A fire-proof partition separates the roomy compartment containing the bus-bars and all of the high-tension apparatus—lightning arresters, disconnecting switches, oil switches, transformers, etc.—from the motor room, and the entrance from one to the other is

closed by fire-proof doors. Imbedded in and forming part of the partition is the switchboard, containing two incoming line panels, two high-tension transformer panels, and two low-tension main motor panels, equipped with the necessary ammeters, voltmeters, low-tension lever switches for controlling the main pump motors, and handles for the remote control of the high-tension oil switches, which are installed in fire-proof brick cells. On these panels are also installed the lever switches controlling the auxiliary motors, and the

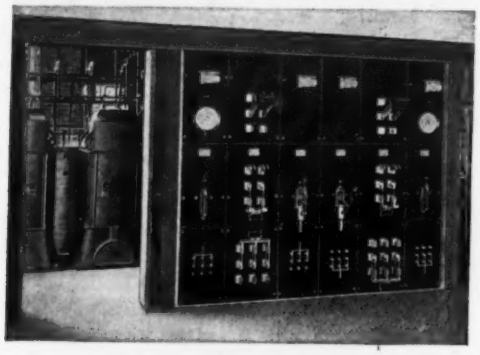


FIG. 3.—SWITCHBOARD AND TRANSFORMERS.

vacuum and water pressure gauges. Fig. 3 gives a view of this switchboard, with the transformers, high-tension switches, bus-bars, etc., visible through the open door at the left.

The electrical layout is designed to co-operate with the use of the two independent supply lines in preventing any possibility of a total shutdown of the entire plant, upon the continuous operation of which depends the water supply of the city of Schenectady. Two sets of low-tension busses are provided, and double-throw switches enable either of the two banks of transformers to be switched on to either one of the two sets of bus-bars. The main and auxiliary switches are also double-throw, to facilitate switching over from one bus to the other.

The electrically-driven turbine pump requires less than half of the space needed for the most compact form of reciprocating steam pumping plant of equal capacity. A comparatively light and inex-

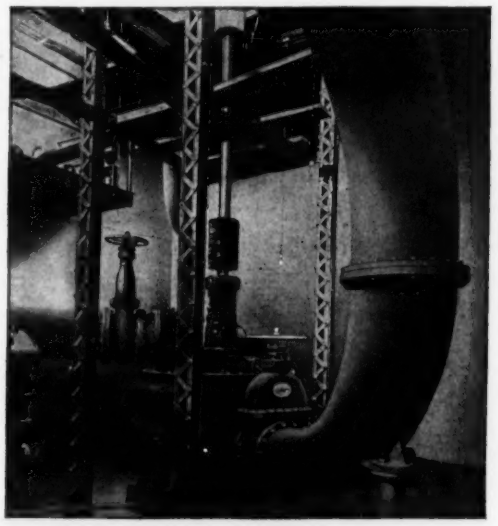


FIG. 4.—CENTRIFUGAL PUMP.

pensive foundation is required, as there is an entire absence of stresses due to reciprocating motions. The only moving part is the rotor-driven impeller, and there is comparatively little noise or vibration. Little or no expenditure is required for upkeep and repairs, as the only wearing surfaces are the bearings. The attendance and depreciation are, therefore, nominal.

New Locke Insulator Factory.

Mr. John S. Lapp, secretary and treasurer of the Locke Insulator Manufacturing Company, of Victor, N. Y., advises us that they have broken ground for a two-story addition to their plant, 50 ft. by 150. They are also erecting two very large porcelain kilns in addition to their present equipment. This addition to their plant is literally carrying out an annual practice since the erection of the pottery, and the additions are becoming larger each year.

New Westinghouse Apparatus.

Following the successful development of the single-phase, alternating-current railway motor, the Westinghouse Electric & Manufacturing Company has placed upon the market a complete line of motors of similar characteristics, but smaller capacity, for the operation of electric cranes, hoists, elevators and similar apparatus demanding a heavy starting torque and a wide range of speed variation under control of the operator. Like the alternating-current railway motors, these motors are of the series-wound commutator type, with compensating field windings, laminated cores and inwardly projecting poles.

The fields consist of laminated cores built up of sheet-steel punchings held between end plates and mounted within cast-iron frames. The frames are of the box type and are closed at the end of substantial brackets which support the bearings, which may be turned 90° and the motor mounted upright or with feet bolted to a vertical surface. The large opening around the commutator is closed by a sheet-steel band fastened by thumbscrews and so arranged that easy access may be obtained to commutator and brush holders at

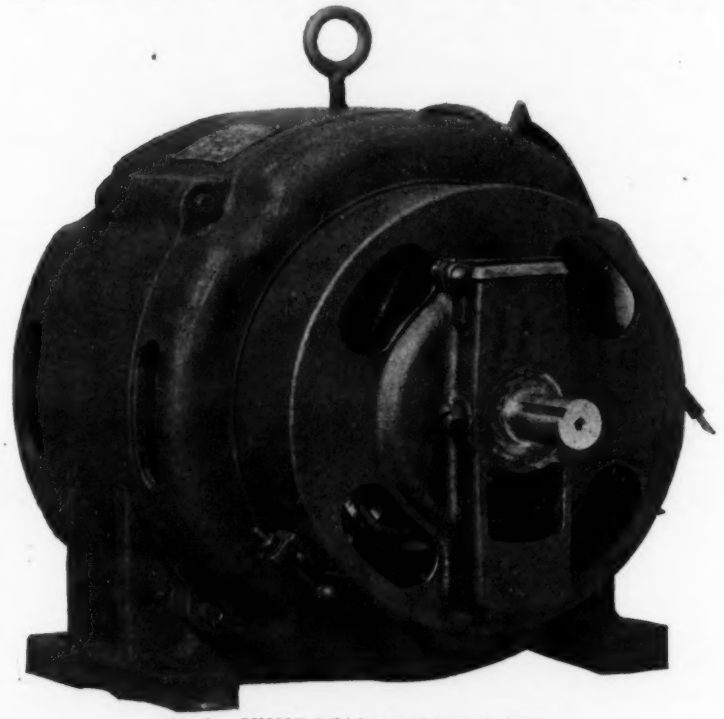


FIG. 1.—SINGLE-PHASE ELEVATOR MOTOR.

all points. Grease lubrication is used, drip cups being provided under the bearings.

There are four inwardly projecting poles integral with the laminated steel core and magnetized by field coils of the usual type. An auxiliary field winding is also provided, threaded through slots in the pole faces.

The armature is of the usual laminated and slotted drum type. In the larger sizes ventilating ducts are provided between the punchings, through which air is forced out against the field coils and core. The commutator is mounted upon an extension of the armature spider. Wiper rings are provided to protect the armature from grease. The shafts are extended at both ends to accommodate pulleys, pinions or brake discs.

The carbon holders are the same as the standard Westinghouse holders which have been so successful in direct-current practice, and consist of rectangular boxes machined to fit the brushes. An even pressure is maintained by a long, flat spiral spring, while the smaller vibrations are taken up by a short spring.

The motors are wound for a nominal potential of 200 volts, at 25 cycles, or 100 volts at 60 cycles, but will operate successfully upon voltages 10 per cent higher. For other potentials it is advisable to use transformers. They are manufactured in sizes having nominal ratings from 5 to 35 hp. For larger capacity the standard single-phase, alternating-current railway motors are recommended. The design of the armature, field and compensating windings is such that the alternating-current machines resemble direct-current, series-wound motors in operating characteristics; practically the same increase in speed with decrease in torque is found.

The speed of motors of this type may be varied by any method

which will vary the e.m.f. impressed at the motor terminals. On account of its simplicity and effectiveness the rheostatic method of control, similar to that used with direct-current, series-wound motors, has been adopted as standard. The controllers and resistances are similar to those used with direct-current motors of similar capacity and are of the well-known Westinghouse dial type or commutator type, according to the size of the motor with which they are to be used. Resistances are mounted in the controller frames. Contact fingers are carried on a moving part having four radial arms and can be operated by a single handle or a system of bell cranks and levers. The operating rod can be connected to either the right or left-hand side of the rocker arm, so that the controllers can be mounted face to face or back to back, as may be most convenient. A single movement forward or back applies the current for the operation of the motor in either forward or reverse direction. Controllers of the dial type have 12 steps, those of the commutator type 16 steps, in either direction. The great number of steps reduces sparking at the contacts. Contact segments and fingers may be easily renewed. With the smaller controller the resistance is formed of wire wound with insulated bars, which are supported in the frame by porcelain blocks. With the larger controllers resistances of the grid type are employed.

These controllers differ from those used with direct-current motors mainly in that blow-out magnets are not used. As the circuit is broken at four points arcing is reduced to a minimum. At the first notch of the controller all contacts make connection simultaneously, with a maximum resistance in circuit. Succeeding steps are made by one set of fingers at a time. The large number of steps employed makes possible a very exact speed control, with a smooth start and a gradual acceleration, and reduces the starting current to a minimum. All parts are easily accessible and the entire mechanism is simple and easily operated and maintained.

For use with this type of motor a complete line of automatic electric brakes, similar to those employed with direct-current, series-wound motors, and with induction motors in crane and hoisting service, has been developed. The device consists of a set of brake shoes, levers and magnet coils, which are mounted upon the front end bracket of the motor, and a brake wheel which is mounted on the motor shaft. The shoes are lined with a special composition and are applied to the wheel by the action of the armature of an electromagnet. A turn-buckle adjustment provides means for taking up wear. The electromagnet consists of a U-shaped core and a U-shaped armature with two windings—one around each limb. Electrical connections are made across the line through a switch on the controller. The switch is automatically operated with the first step of the controller. When closed, the armature of the electromagnet is raised and the brake released. When movement of the controller to the off position opens the switch, the armature of the electromagnet falls under the action of gravity and the brake is set. The armature is connected with the brake shoe by means of links in such a way that it is practically impossible for the brake to fall when the controller is in the off position. Should the power fail while the motor is operating, the brake is immediately set and the load held. As both brake and controller are operated by the same mechanism, it is impossible to set the brake while the motor is connected to the line.

The motor, controller and brake mechanism here described constitute the more important elements of a complete electrical outfit for the operation of cranes, hoists and similar apparatus on the alternating-current system.

An induction motor may be started either by connecting the motor directly to the supply circuit or by applying a low voltage until the motor has attained a fair speed, and then by one or more steps raising the potential until it reaches its normal value. The first method may be used only with motors under 5 hp, for when the full voltage is impressed on the motor in starting it draws a current equal to several times full load current, which causes a heavy drop in the supply circuit and is detrimental to the regulation of the system. Further, the excessive strains thrown on the winding of the motor by starting in this manner causes deterioration in the insulation of large size motors.

These considerations make it necessary to provide an auto-starter, which usually consists of an oil-immersed switch or switches of the drum type used in conjunction with two auto-transformers, so connected as to apply gradually increasing voltages to the terminals of the motor. The number of points varies from three to nine, depending on the size of the motor. The advantages of a gradual development of torque manifest themselves both in the motor and in the line regulation.

The Westinghouse Electric & Manufacturing Company manufactures oil-immersed auto-starters for use with all sizes of constant-speed induction motors from 5 to 2,000 hp, of various voltages, frequencies and two and three-phase. The one shown in the illustrations was constructed for the control of a 1,400-hp, 2,200-volt motor. The switches, circuit-breakers and operating devices only are mounted in the case, and, since the auto-transformers are standard, they are not shown.

This controller has eight starting and one running points. At the first starting notch a low voltage is impressed on the motor, and as each succeeding notch is passed, the voltage is increased until the full line potential is reached and the motor attains its running speed. The motor circuit is never opened in passing from one starting point to another, as preventive resistances are inserted between the different notches. Destructive arcing and wear on the contacts are thus prevented, as are also the fluctuations in the line due to starting the motor. The two auto-transformers mounted outside the case, in connection with the preventive resistances, furnish the necessary reductions in voltage for starting.

The controller is equipped with two automatic line circuit-breakers and two non-automatic breakers, upon which the circuit is broken when changes in voltages are made, thereby saving the current-carrying contacts of the drum switches. By the first turn of the hand wheel the circuit-breakers are closed, and the motor is connected to the first point of each auto-transformer, both direct and through the preventive resistances. The next step connects the motor through another set of resistances to the next higher voltage, disconnects the motor from the lower voltage and finally short-circuits the resistance on the higher voltage step. This is continued with each of the eight steps until the motor is connected to full line voltage.

The two non-automatic circuit-breakers are actuated by cams connected to the shaft of the hand wheel, which is turned through 180° for each notch of the controller, the change from point to point being shown on the indicator below the wheel. At any position a slight backward turn of the hand wheel will cause the main line circuit-breaker to open, and the word "off" to replace the word "on" upon the shutter just above the hand wheel. An overload on the motor will also cause this breaker to open. In either case it is necessary to return the wheel to the initial starting position before the circuit-breaker can be closed. The tripping coils are so connected that only a part of the turns are in circuit when starting, thus increasing the capacity for the heavy starting currents and insuring greater protection when running. The oil tank may be lowered by the crank at the side, and the upper part of the case removed, thus exposing all parts for ready inspection and repair.

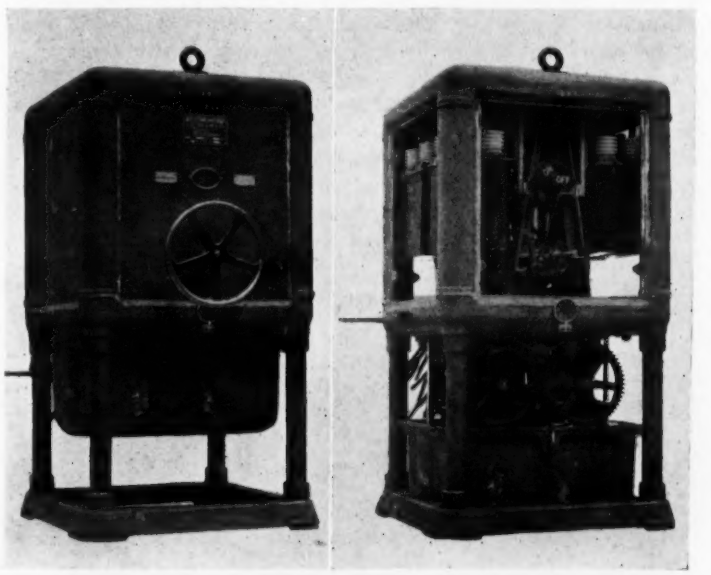


FIG. 2.—AUTO-STARTER FOR 1400-HP INDUCTION MOTOR.

This auto-starter was designed for starting motors of from 600 to 2,000 hp capacity at 2,000 volts, either two or three-phase, the size of motor that can be handled depending on the conditions of

service. Direct-current starting rheostats and controllers, though operating satisfactorily when used to start motors driving bucket conveyors where the machinery is started but once or twice a day, will, unless designed for heavy service, heat excessively if used to start motors of the same capacity when driving roll tables and soaking pits where sudden and repeated starting and reversing is required. Similarly, the heating of the auto-transformers and the controller contacts depends on the frequency of starting and the starting torque required of the motors. As this apparatus is intended only for starting, it cannot be used for varying the running speeds of the motor.

Transmission systems operating at potentials of from 5,000 to 20,000 volts are to-day in common use. While the main object of these systems is to transmit power from a generating station to the center of distribution, it is often of decided financial advantage for the operating company to retail power along the transmission line. This power may be used for pumping, for the irrigation of farms and ranches, for mill, mine and factory purposes, and for the lighting of small outlying communities. As the volume of business does not always justify the maintenance of a sub-station, the Westinghouse Electric & Manufacturing Company has developed a line of transformers for this class of service known as the high-tension O. D. type.

The severe conditions of service which these transformers have to withstand have been given great consideration in their design, and a line of apparatus has been produced whose ruggedness and durability are exceptional. Particular attention has been given to insulating these transformers to withstand the strains due to lightning and static disturbances which occur on high-tension lines. The same method of insulating has been followed as in the large high-voltage apparatus. They are all designed for operation in oil, which acts both as an insulator and as a cooling medium. The transformers have given universal satisfaction wherever installed and have proven themselves to be exceedingly long-lived under the most trying conditions.

The smaller sizes of transformers are mounted in cast-iron cases and larger sizes in cases having corrugated sides of heavy sheet steel with heavy cast-iron tops and bases. All cases are absolutely water-proof. The smaller sizes are provided with lugs and hanger irons for mounting on poles, and their light weight makes them convenient to install.

The high-tension winding of these transformers is provided with two taps, by means of which five, ten or fifteen per cent of the total number of turns may be cut out, and the effective winding correspondingly reduced. By applying normal high-tension voltage to any one of these taps, secondary voltage may be boosted in proportion to the number of turns cut out, or the normal low-tension voltage

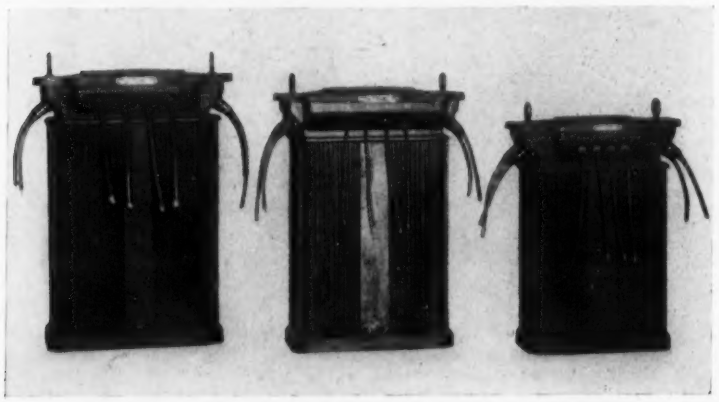


FIG. 3.—50, 20 AND 10-KW, HIGH-TENSION TRANSFORMERS.

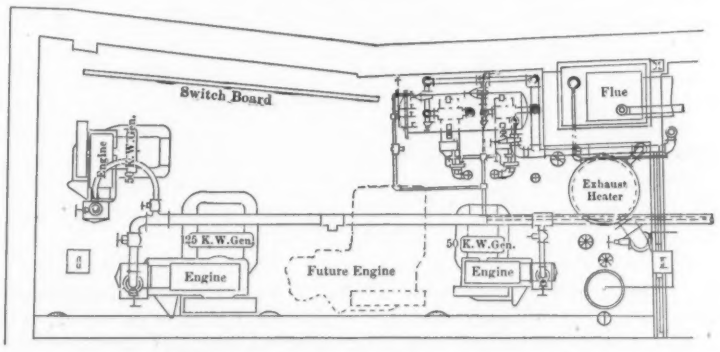
may be maintained when the primary e.m.f. falls below its rated value. This flexibility of ratio is a valuable feature.

These transformers are manufactured in sizes from 1 to 50 kw for primary voltages up to 16,500, with 440 and 220 or 220 and 110 as standard secondary voltages. A line with capacities of from 10 to 50 kw is arranged for 2,200 and 1,100-volt secondaries, while another line ranging from 15 to 50 kw supplies low-tension current at 2,400, 2,300, 2,200 or 2,100 volts. The 60-cycle type may be successfully used on circuits of 6,000 to 16,000 alternations, the 25-cycle type on circuits of 3,000 to 4,800 alternations. In electrical performance these transformers show good efficiency at all loads, and the regulation approaches that of central station apparatus.

A Boston Office Building Electrical Plant.

A new power plant has recently been placed in service at the headquarters of the John Hancock Mutual Life Insurance Company in Boston. The plant is designed to supply current for lighting and power service, water for the operation of elevators, heating, etc., to the block of the company's buildings, bounded by Franklin, Federal and Devonshire Streets. A large part of this block is to be torn down within the next year or two, and upon the site will be built one of the handsomest office buildings in the city. The building will be of fire-proof construction, and the first story will contain two large banking rooms and four stores, while the rest of the building will be occupied by 430 offices. The first half of the building, on the Federal Street side, is already completed, and the power plant is located in the sub-basement of this structure. The plant is at present supplying current to the old John Hancock Building adjoining the new premises and to the other tenants in the group of buildings owned by the company. When completed the new building will contain eight elevators, and the first floor corridor will connect with the old building in which the company's general offices are now located.

The boiler room, which contains four 220-hp Babcock & Wilcox water-tube boilers, is about 50 ft. long, 18 ft. wide and 20 ft. high. The walls are faced with white enamel brick. The boiler room is lighted by eleven 16-cp incandescent lamps. The enameled tiles



ARRANGEMENT OF EQUIPMENT IN POWER HOUSE.

are extremely useful as reflectors, aside from their handsome appearance. Each boiler is equipped with a smoke consumer. The boilers are built of open-hearth steel and may be run at 200 pounds steam pressure if desired.

Adjoining the boiler room is a coal pocket having a capacity of about 35 tons. Coal is dumped by gravity into this pocket from scuttles on the Federal Street side. A track connects the boiler room with the coal pocket, and upon this track is pushed a coal car having a capacity of one ton. Platform scales are provided in the track at the entrance of the boiler room, and coal is discharged through a hopper by gravity from the bin into the car as it is needed. The location of the plant in the sub-basement greatly simplifies the coal-handling process—an expensive matter in many isolated plants where the force of gravity cannot be used to advantage. The boiler feed pumps are two in number. They are of Worthington make, each being 7½ in. by 5 in. by 6 in. Water supplied to the boilers is measured by a Worthington meter. A large shower bath and toilet room for employes is located just outside the boiler room. The ventilation of the boiler room is unusually effective. It is accomplished by a 40-hp Sturtevant motor direct-connected to a 48-in. fan which blows fresh air into a 24-in. by 30-in. duct extending with branches throughout the basement just beneath the ceiling. Ventilating hoods with adjustable dampers resembling the ventilators used on ships point downward at various places in the boiler room for the delivery of pure air. Filtered water is supplied for drinking purposes.

The engine room, which is located on a mezzanine floor above the boiler and pump rooms, is about 50 ft. long by 25 ft. wide. Its walls are lined with enamel brick. The illumination is furnished by 17 16-cp incandescent lamps. The generator capacity is 225 kw, composed of two 50-kw machines and one 125-kw outfit. Each unit consists of a three-wire direct-current General Electric generator direct-coupled to an American-Ball simple engine. The larger machine consists of a 16-in. by 16-in. horizontal non-condensing engine, making 230 r.p.m., driving a 220-volt generator. The outfit occupies a floor space of 130 sq. ft., or 1.04 sq. ft. per kw, and weighs, ready for

shipment, 34,200 pounds or 274 pounds per kw. The guaranteed steam consumption is 29 pounds per indicated hp-hour at normal load. The clearance is 2 per cent and speed regulation 1 per cent. An interesting feature of the engines is the oiling system. A small storage tank is located beneath the rock-shaft bracket on the side of the engine frame, and in this tank is a small pump which is driven from the rock shaft. The pump forces the oil through the various bearings, and after use the oil falls to the bottom of the engine frame, returning by gravity to the storage tank, on entering which it passes through a fine wire gauze strainer, which removes everything from the oil that can be separated from it without filtering.

The 50-kw generators are also 220-volt machines. Each is driven by a 12-in. by 11-in. engine, making 265 r.p.m. Each of these units occupies a floor space of 71.5 sq. ft., or 1.43 sq. ft. per kw. Space is provided as shown on the drawing for a fourth unit, which will probably be of the duplex compound type, and of 150 kw rating. The normal steam pressure of the plant is 100 pounds. The engine room is provided with a cork floor.

The present connected load upon the electric plant consists of about 900 16-cp lamps in the new John Hancock building and some 1,400 lamps in the older portion. Distribution is carried out by armored conduits. There is a considerable fan motor load in the summer and an all-the-year-round load of the following motors: A 15-hp Sturtevant motor driving a 42-in. fan for toilet ventilation in the new building, located on the roof. A 25-hp Sturtevant motor driving a 52-in. blower for basement ventilation, located in basement. A 40-hp Sturtevant motor driving a 48-in. fan for sub-basement ventilation, located in boiler room. A 35-hp De Laval motor, 1,660 r.p.m., driving a centrifugal hot water supply pump, in the engine room. (There is a duplicate set in the engine room consisting of a 35-hp De Laval steam turbine, driving a centrifugal pump 2,000 r.p.m. for lifting 1,400 gallons of hot water 60 ft. per minute. The turbine itself makes 20,000 r.p.m. and is connected to the pump through a 10 to 1 reduction gear.)

The old building carries two 10-hp motors on its roof, each coupled to a 30-in. Davidson fan, for ventilating the offices. In the basement of the old building is a 25-hp motor driving an 8-ft. blower having 12-15-in. by 3½-in. buckets used for forcing hot air through the building. The Johnson system of heat regulation is installed in the old building, while the new structure is heated by hot water on the Evans-Admiral system.

The station contains one of the handsomest isolated plant switchboards in Boston. It is extremely simple in arrangement and consists of four generator, one totalizing and seven feeder panels of blue Vermont marble. It is 26 ft. 8 in. long and 90 in. high. Standard equipment of General Electric make is installed upon it. Open fuses are used on the rear of the board.

An elaborate elevator pumping plant is nearing completion in the new building, the pumps being located in the sub-basement. The day load is handled at present by a Deane duplex compound steam pump, 20 in. by 30 in. by 16 in. by 18 in. At night the elevators are run by a smaller Deane pump of the simple duplex type, 14 in. by 8½ in. by 10 in. The most interesting pump, however, and the first of its kind in Boston, is a large three-cylinder compound high-duty machine. It is a Laidlaw-Dunn-Gordon pump with Corliss valve gear; cylinders: steam hp, 17 in.; 2 e.p., 20 in.; water, 7½ in.; stroke, 24 in. It has a capacity of 1,300 gallons per minute at 150 pounds pressure, and an expected steam consumption of 25-27 pounds per hp-hour. The elevator equipment of the new building was furnished by the Plunger Elevator Company, of Worcester, Mass. Mr. James Stackhouse is superintendent of the building.

Direct-Current Circuit Breakers.

The automatic circuit-breaker illustrated in the accompanying cuts represents a successful attempt to reduce this device to its simplest possible form. In Fig. 1 is shown a double-pole breaker which consists of two single-pole breakers, mounted side by side, each breaker being operated by its own individual mechanism. Inasmuch as each half is a separate unit, it is impossible to close the circuit on overload. It is unnecessary, therefore, to use switches in connection with these breakers.

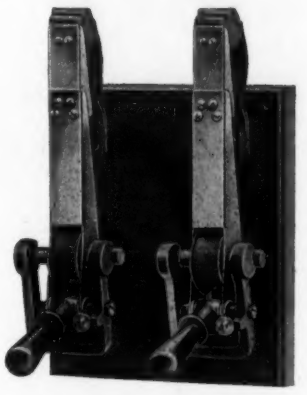


FIG. 1.—DOUBLE-POLE BREAKER.

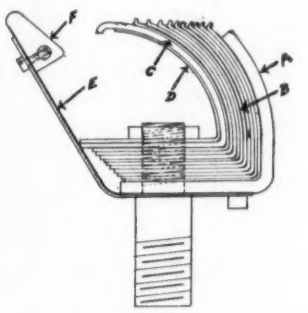


FIG. 2.—DETAILS OF 125-250-VOLT CONTACTS.

In Fig. 2 are shown the details of the contacts of a breaker for a 250-volt circuit. The line terminal is fastened to a stud threaded in the lower portion of the laminæ and makes contact with each lamination. When the breaker opens the current is shunted to a copper contact and then to a carbon block on which the final break is made. The usual pivot form of carbon contact has been replaced by a flat steel spring which affords the necessary resilience without the complication of an additional joint. The construction of the operating coil is shown in Figs. 3 and 4. The coil is composed of laminations wound in a spiral, the convolutions being insulated from each other. One end of this coil is fastened to a moving arm and the other end to the base. The tripping is done by a U-shaped armature provided with an air-gap adjustable by a screw. The closing mechanism consists of a hardened steel roller journaled in the closing lever and bearing on a hardened steel seat in the base. This construction produces a roller action which makes the closing easy, the locking positive and the operation sure. (See Fig. 5.)

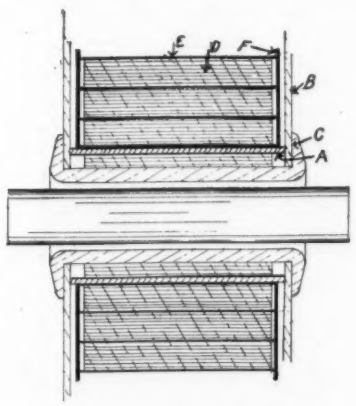


FIG. 3.—DETAILS OF MAGNETIC COIL.

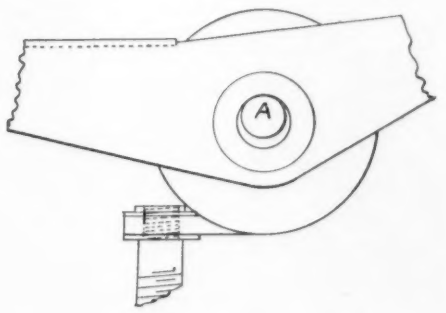


FIG. 4.—FINAL POSITION OF COIL IN ARM.

FIG. 5.—BREAKER MECHANISM CLOSED.

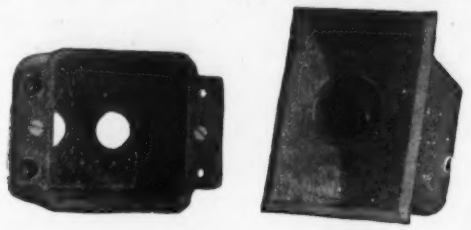
In the breaker described the coil of each pole is self-contained, and, therefore, each pole is independent in its operation. Grounds, accidents, etc., which may affect the service of one coil will not disable the entire breaker.

These automatic circuit-breakers are made by the Switchboard Equipment Company, Pittsburg, Pa.

Switch Box.

The R. M. Cornwell Company, of Syracuse, N. Y., has recently perfected, and is now putting on the market its "Universal" switch-box. This box is built according to the national code standard, approved and listed by the National Board of Fire Underwriters.

It is so arranged that it can be used for either new or old work, and is made in two sizes. The No. 1 box is so arranged that it will



SWITCH BOX.

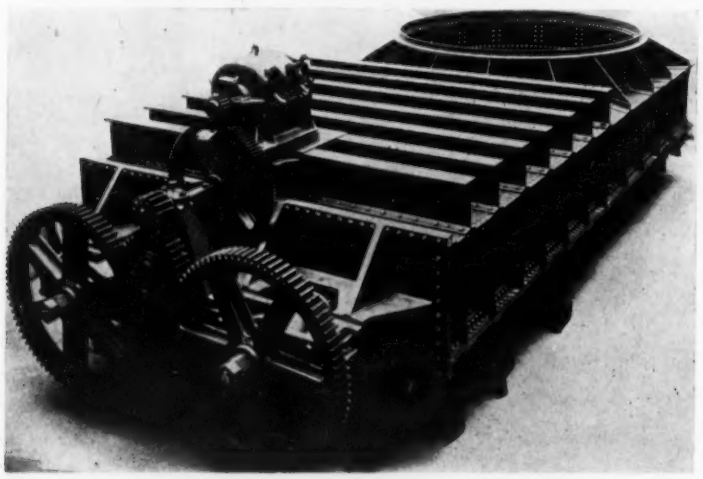
take all kinds of flush snap switches of either the round or the square type, either single-pole, three-way or double-pole.

The No. 2 box is arranged to take all kinds of flush, push button, rotary, rectangular switches and receptacles. It is made for double-pole, three-point and single-pole work.

The box is very simple and durable, and made of a special grade of cast iron, japanned to prevent rusting and to make it thoroughly fire-proof.

Foot Valves at Plant of Ontario Power Company.

There is given herewith a view of one of the gate valves which are now being installed at the plant of the Ontario Power Company, Niagara Falls. Six of these will control the flow of water from the main 18-foot conduit to the 9-foot vertical penstocks which descend through shafts and tunnels to the turbines at the power house below. The penstocks take off from the under side of the conduit, and the valves are placed in a chamber beneath the conduit just below the taper connecting section, nine feet below the conduit. The placing of the valves thus on the under side of the conduit was necessary on account of the very limited space, and since the conduit is laid in the Queen Victoria Niagara Falls Park, it will be covered with earth. The housings and operating mechanisms are in arched chambers under the conduit, access to which is had through shafts coming to the surface of the ground alongside of the conduit. All



9-FT. PENSTOCK GATE VALVE.

six of the valves have been received from the makers, Ransomes & Rapier, London, England, and are now being set in place.

The castings of these valves are rectangular in shape, and made of steel plates heavily reinforced with angles. For convenience in handling they are made in three parts and bolted together so they may be easily assembled and taken apart. A partition through which the gate slides, divides the casing in the middle. When the gate is fully open, a door carried by the gate closes the opening in this partition, thus making water-tight the half of the casing into which the gate is drawn. The water may be drained off from this half through a six-inch valve in the bottom, and the gate itself examined through a manhole without interrupting the flow of water through the penstock. The gate or paddle is fastened to the water-tight door by rods through compressed helical springs. The nuts may be taken off the ends of the rods and the door left in place while the whole gate and end of casing with operating mechanism attached is removed for attention or repairs. After replacing the gate and end, and before removing the water-tight door, the casing is filled with water through a two-inch pipe connecting with the penstock.

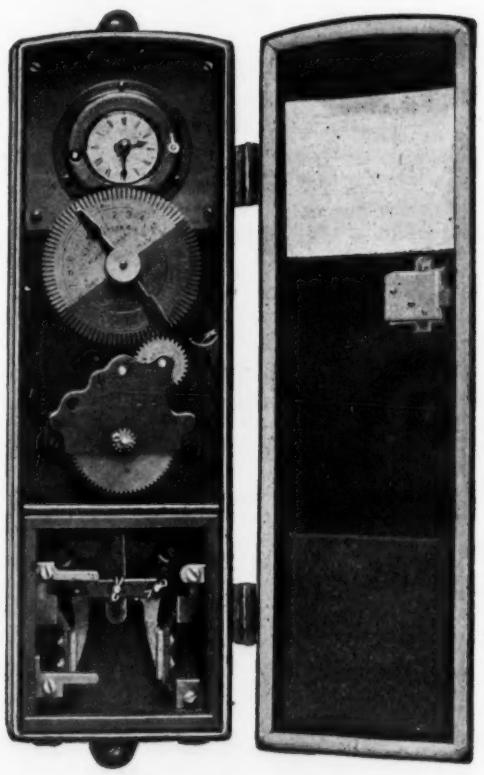
The paddles of the gates are made of steel plates and sections bolted securely together; auxiliary sluices in each gate serve the purpose of a by-passs. The gate is moved by two block-nuts running on screws, and these nuts are fastened to the sides of the auxiliary grid sluices so that upon opening, the first three inches of movement of the block nuts open the by-pass, and upon closing, the first movement closes them again.

The screws are driven by a geared 30-hp electric motor, which opens the gate in three minutes. The thrust of the screws is taken on ball bearings, and the block nuts and sliding surfaces are lubricated by compression grease cups.

The head upon the gates is 50 ft., equal to a total weight of 124 tons, and each gate controls the flow to one double spiral turbine of 11,390 hp capacity, using 700 second-feet of water.

An Enclosed Time Switch.

The accompanying cut illustrates a recently developed type of time switch for the automatic control of window, sign and street lamps. The main features of this switch are as follows: The clock and switch mechanisms are enclosed in a weather-proof iron box, which protects them from dust and moisture. The switch is of the brush-contact type, and is operated by a toggle, so that the friction is of a minimum value. The clock is of high grade and has a



TIME SWITCH.

jeweled movement. It has ordinary minute and hour hands, so that its time-keeping qualities may be accurately observed. The setting of the switch for operation at a desired time is done on a twenty-four-hour dial by moving either of the pointers on the dial to the mark indicating the time for operation. The twenty-four-hour dial is divided in halves, one of which has a light finish, indicating day, and the other has a dark finish, indicating night. All adjustments or settings of the clock or the switch are effected without tools.

This time switch, which is being placed upon the market by the Albert & J. M. Anderson Manufacturing Company, 289 A Street, Boston, is claimed to operate reliably under conditions which interrupt the operation of most other time switches.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Complaint is still made quite generally of the unseasonable weather conditions, which affect the distribution of merchandise and agricultural development. The uncertainty as to crops causes dealers in the farming districts to exercise more caution regarding the accumulation of supplies beyond current requirements. Otherwise the trade situation is reported satisfactory; fundamental conditions are sound, payments reasonably prompt, and failures below the average. Manufacturing activity is fully maintained, the percentage of idle machinery being smaller than at any recent date, and the textile industries make notable progress under the stimulus of advancing raw materials. Structural shapes have taken the position of prominence in the iron and steel industry. Building operations are now under way, and the tonnage of steel required will keep mills fully occupied for some time. In addition to numerous extensive office buildings and manufacturing plants there are special railway terminals that swell the volume of business to a remarkable aggregate. Motive power and rolling stock for the railroads cannot be delivered as rapidly as required, and these sections of the industry are crowded to their utmost capacity. In several other departments, however, there is more or less irregularity, and the possibility of demands for higher wages on July 1 tends to generate conservatism in the acceptance of long-term contracts at current quotations. Railway earnings continue exceptionally good despite the smaller cereal movement, the first quarter of 1905 showing a gain of 7 per cent in net on a gross gain of 5 per cent. For nine months of the fiscal year net returns have increased 7 per cent on a gross gain of 3 per cent. Exports are close to the record for the season, and some gain is noted in corn, which may be taken as indicating a turn in the tide of the grain trade. Lumber at New York is quieter, but more business is doing in New England. On the Pacific coast the lumber trade is improving. In copper there was more activity, considerable of the metal being sold at 15 to 15⅛c. The asked prices, at the close, were 15c. for Lake and electrolytic, and 14¾c. for casting stock. The number of business failure during the week ending May 18 was 191, according to *Bradstreet's* tabulation, against 158 the week previous and 215 the corresponding week of last year.

THE ABNER DOBLE COMPANY, of San Francisco, announces that arrangements have been made with the John McDougall Caledonian Iron Works Company, Limited, of Montreal, Can., whereby the latter become sole licensees for the manufacture of the Doble system of water wheels in the Dominion. The tangential water wheels and needle regulating nozzles manufactured by the Abner Doble Company are well known for their excellence of design and workmanship, and considerable engineering interest has recently been shown in Canada as well as elsewhere in relation to the four 8,000-hp wheels built for operation in California power plants. The McDougall Company has the most extensive machine shops in Canada, its plant including machine shops, pattern shops, foundry, forging works and structural material shop. The plant is, therefore, well equipped for manufacture of water wheels and other hydraulic machinery. It has already in hand the building of a 100-hp wheel to operate under 170 ft. head, taking water through a 3½-in. jet and having a speed of 130 revolutions per minute. The Canadian licensees will furnish the steel pipe, structural work and all machinery necessary for complete power plants, and the Doble Company requests that all engineers or others interested in water power developments in Canada will address the McDougall Company direct. The Doble Company has been retained as consulting engineer.

OHIO TELEPHONE EXTENSIONS.—During this year the United States Telephone Company, of Cleveland, O., will spend $250,000 on extensions of its lines into new territory. When this money has been spent it will mean a wide extension of the facilities of the independent telephone companies. The plan has also been approved of putting in a direct wire between Cleveland and Toledo. Heretofore Cleveland and Toledo have been connected via Kent. It has been found that this line is already busy and that the Cleveland business makes its difficult to handle all of the traffic. A line is to be run from Cleveland direct to Toledo to take care of the business between the two points. The old wire will be used to take care of the business between Pittsburg and Eastern points and Toledo, while the Cleveland to Toledo line will be used for the local service and also to accommodate the Eastern through service from Albany and Buffalo.

APRIL'S FINE EXPORTS.—The Department of Commerce and Labor, through its Bureau of Statistics, has issued the preliminary statement of the foreign trade of the United States for the month of April. The imports of merchandise free of duty amounted to $44,694,773, as against $37,154,766 in April of 1904, while those dutiable were $50,941,369, as against $46,367,116 dutiable imports in April, 1904. Domestic exports of merchandise for April amounted to $126,137,432, and foreign exports to $3,220,797, being a total of $129,358,229 and an excess of domestic exports over imports of $33,722,087. The total exports for April, 1904, amounted to $109,880,405, and the excess of exports over imports for that month to $26,358,523. For the ten months ended April 30 imports of merchandise totaled $935,072,990, as against $829,231,975 for April, 1904, and exports totaled $1,275,059,368, as against $1,277,715,480 for April, 1904. Manufactures for the ten months show an increase of nearly $68,000,000.

ELECTRIC LIGHTING ON PACIFIC COAST.—The Angelus Hospital, of Los Angeles, Cal., has closed a contract with Charles C. Moore & Company, of San Francisco, for a complete steam and electric power plant for lighting the building and heating it by the exhaust steam. The plant is to include three Ideal high-speed engines, each direct-connected to a Westinghouse direct-current generator, of which there are two of 35 kw each and one of 15 kw. Babcock & Wilcox boilers will be installed. Charles C. Moore & Company have also been awarded a contract to supply a complete electric lighting plant for the Lander Electric Light & Power Company, of Lander, Wyo. The contract calls for a Babcock & Wilcox water-tube boiler and Harrisburg high-speed engine of 125 hp, direct-connected to a Westinghouse 75-kw, three-phase generator.

THE ALLIS-CHALMERS COMPANY'S agency in San Francisco, has closed contracts with the Oregon Water Power & Railway Company for a hydro-electric transmission of 17 miles, from the new dam on the Clackamas River to Portland. The equipment will include three direct-connected sets, each consisting of a Bullock 2,500-kw, three-phase, 11,000-volt generator, and a 5,000-hp Francis-type turbine of Allis-Chalmers manufacture, operating under a working head of 120 feet. Escher-Wyss governors will regulate the wheels. The surplus electric power, not needed by the Oregon Water Power & Railway Company, will be sold to the Portland General Electric Company. The dam will be constructed so as to admit of an increase of capacity to 40,000 hp.

BIDS FOR NAVY SUPPLIES.—Bids will be received until June 6 by the Bureau of Supplies and Accounts, Navy Department, Washington, for furnishing at the navy yards at Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; New York, N. Y.; League Island, Pa.; Washington, D. C.; Annapolis, Md.; Norfolk, Va., and Charleston, S. C., a quantity of naval supplies, as follows: Motors, incandescent lamps, dry batteries, switches, electrical supplies, starting panel, vitrified conduit, terra cotta pipe, portable crane, etc. Address H. T. B. Harris, Paymaster-General, U. S. N.

BIDS FOR ELECTRIC LIGHT PLANT AND WATER-WORKS.—Bids will be received until June 8 by the city clerk, Alma, Neb., for furnishing material and constructing an electric light plant and water-works systems, consisting of a 10-in. tubular well, power house, machinery setting, etc., two 60-in. x 14-ft. return-flue tubular boilers and a 150-hp heater, one 60-hp high-speed engine, one 40-kw direct-current dynamo and fixtures, poles, wire, lamps, etc. M. A. Earl, 1416 First National Bank Building Chicago, Ill., is the consulting engineer.

BLUE PLAINS, D. C., BIDS.—The time for receiving bids for constructing and installing heating, lighting, power plant, and water supply for the Industrial Home School at Blue Plains, D. C. (see issue of May 6), has been extended by the Commissioners of the District of Columbia from May 31 to June 10.

BIDS FOR POWER PLANT.—John P. Cahoon, owner of the Salt Lake Pressed Brick Yards, Salt Lake City, Utah, will soon let contracts for the construction of an electric power plant, which it is estimated will cost, without the transmission line, $40,000.

CRANE BIDS.—Bids will be received until June 10 by Mordecai T. Endicott, Chief of Bureau of Yards and Docks, Navy Department, Washington, D. C., for installing a 15-ton electric traveling crane in Building No. 37, at the Norfolk Navy Yard.

ELECTRIC VERSUS STEAM TRACTION.—Reports are current as to a change of control of the Philadelphia & Western Railroad and as to the construction of an electric system to compete with the Pennsylvania for suburban traffic.

THE COPPER MARKET.—The bulletin of the National Conduit & Cable Company discusses the copper market as follows: "Copper circles see evidences of a revival of interest in the metal, and recent business has grown to much larger dimensions than the average of a few weeks ago. In fact, the buying has been in fairly heavy volume, and indicates the renewal of confidence in the market. Europe has bought with greater freedom, and the local demand has led to liberal sales. The activity started at 15 cents, but present quotations for Electrolytic Wire Bars are 15 to 15¼. General conditions in the copper trade were unusually quiet in the latter part of April and early May, but at the present time there is a distinct tendency to increased firmness. A few weeks ago the market settled to the basis of 15 cents, and for a time considerable uncertainty enveloped the situation. Predictions were in the air that lower prices might be expected, and this prospect temporarily held up orders. There was some whistling to keep up courage in certain quarters, and more than one producer showed the extent of his confidence by prematurely shading the market to catch orders. The market is regaining its firmness, especially since foreign buying for European and China shipment has been resumed on an important scale. There has been some good buying for domestic account, and at this writing the market position is firmer than a short time ago. Good demand has changed the outlook. Buyers have forgotten their conservative disposition to a considerable extent, and have apparently reached the conclusion that there is no reason present or prospective for holding aloof from supplying the requirements of the next thirty to sixty days. The export movement is maintained at a remarkably high level, and while this lasts at the rate established since the first of the year, the probability of a pronounced drop in market values is pushed well into the future."

PALMER MOUNTAIN POWER.—New England is not behind the rest of the country in power transmission work, at home or in other parts of the country. Large new enterprises are constantly cropping up. One of the latest of these is the Palmer Mountain Tunnel & Power Company, organized by residents of Holyoke and Springfield, Mass., to develop mining properties with electric power on Palmer Mountain, Washington. The company has a capital stock of $5,000,000. The officers are: President, John Tilley, Holyoke; first vice-president, F. G. Burnham, Holyoke; second vice-president, E. E. Barr, Springfield; secretary, L. H. Porter, Northampton; treasurer, Samuel Porter, Florence; general manager, John Boyd, Loomis, Wash. The company has placed contracts for electrical machinery to develop 3,000 hp in four units of 750 hp each.

ELECTRICITY IN SMELTING.—Governor Enrique Creel, of the State of Chihuahua, Mexico, states that about $20,000,000 is to be expended in the erection of new smelting plants in that State. He has signed a concession granted to Eugene Davis, of Washington, D. C., and associates for the establishment of metallurgical works aggregating 1,000 tons daily capacity. The concession provides for the construction of three plants, all to be located in the Parral mining district. One plant will be located at Parral, another at Minas Neuvas and the other at Villa Escobedo. This concession includes authority for the installation of a large electric power plant for the operation of the three metallurgical plants. More than $5,000,000 will be expended in the construction of the proposed works and electric plant.

LARGE PRIVATE PLANT.—One of the largest orders for electric power machinery to be installed in a private plant which has been placed for some time is that of Sears, Roebuck & Company, Chicago, Ill. It consists of the following apparatus: three 24 and 50 x48 and one 20 and 40x42, heavy duty cross compound Reynolds-Corliss engines, three 750-kw, 240-volt, multipolar, compound wound, engine type generators, one 500, one 100 and one 50. Each engine is designed for direct connection to its respective generator, and a total of 3500 horsepower will be developed. The installation will furnish current for use in their store at Harvard and Homan Avenues, Chicago, and will be made from plans drawn by Adams & Schwab, Sears, Roebuck & Company's consulting engineers.

DODGE & DAY, engineers and architects, Philadelphia, Pa., have been commissioned by Wm. Knabe & Company, Baltimore, Md. (makers of the famous Knabe piano), to take entire charge of extensive improvements to their plant. The operation includes a new five-story building, 225x50 ft.; new dry kiln and wood mill, as well as numerous changes to the present buildings. There will also be a new power plant, which will involve the purchase of a new engine and generator. Motors will be installed, and considerable electrical work done, as it is the intention to operate the plant electrically throughout.

COALING ELECTRIC PLANTS.—The steamer *T. H. Davis*, lately owned by the Chicago & Eastern Railroad Company, and the steamer *Harvester*, of the Treadwater Coal Company, of Paducah, Ky., have been sold to the North American Company, which has purchased large tracts of coal lands in the vicinity of Sturgis, Ky. Both boats will be used to transport coal to St. Louis for the use of United Railways, Union Electric Light & Power Company, and Laclede Gaslight Company which are controlled by the North American.

SIGNAL CORPS TELEPHONES.—Bids will be called for about June 1 for furnishing the Signal Corps of the Army with telephone apparatus to cost about $75,000. Models of practically all of this equipment may be seen in the Signal Corps Model Room, Washington, and drawings and specifications are under preparation. Bidders should call on Major Edgar Russell, Lemon Building, Washington, for permission to inspect models.

BIDS FOR ELECTRIC LIGHT PLANT.—Stanley Gaines, secretary and manager of the Hawley Electric Light & Power Company, Hawley, Pa., writes that bids will be received May 31 for rebuilding the electric light plant recently destroyed by fire. The probable cost of work proposed is $13,000.

THE STROMBERG-CARLSON TEL. MFG. CO., Rochester, N. Y., reports having closed contracts for switchboards for the following places: Waverly, Ohio; Seattle, Wash.; Kansas City, Mo.; Scenery Hill, Pa.; Benzonia, Mich.; Albany, N. Y.; Rock City, Ill.; Maynard, Ky.

BIDS FOR FIXTURES.—Bids will be received by Capt. Geo. H. McManus, constructing quartermaster, U. S. A., Fort Totten, Willets Point, N. Y., June 2, for electric light fixtures in seven buildings at this post.

SCHOOL EQUIPMENT BIDS.—Bids will be received until June 5 by C. B. J. Snyder, superintendent school buildings, New York City, for installing electric equipment in School 82, Jamaica, L. I.

LIGHTING BONDS.—Bids will be received until May 29 by the village council of Sanborn, Minn., for $6000 bonds for establishing a lighting plant. Geo. Posy is village recorder.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market was depressed and unsettled after a break led by Steel stocks and based upon unfavorable iron-trade rumors, with fears of the effect of a renewed tariff agitation growing out of the Panama Canal situation. Bad weather and crop reports contributed to the bearishness. Most of the electric stocks and the tractions are all down in sympathy with the general market. General Electric declined heavily, the net loss at the close being 8½ points, and the closing price 169. Allis-Chalmers, common, closed at 15, a net loss of 1¼-point, and preferred at 51⅞, a net decline of 2⅛ points. The decline in Westinghouse was the heaviest of the list, being 19½ points, the closing price being 152. Among the tractions, Brooklyn Rapid Transit was quiet and closed at 60⅜, being a net loss of ½-point, and Metropolitan closed at 115¾. Interborough Rapid Transit declined 2 points, closing at 203. Western Union was an exception and made a gain, closing at 93, which is ⅛-point higher; New York & New Jersey Telephone advanced 2½ points net, the closing quotation being 172½. American Telephone & Telegraph is unchanged at 140. Following the lead of the Stock Exchange list, curb prices showed general declines, with a good deal of liquidation and some increase in the volume of business, compared with the previous week. Following are the closing quotations of May 23:

NEW YORK

	May 16	May 23		May 16	May 23
Allis-Chalmers Co.	13⅛	13⅜	Electric Vehicle pfd	18	18
Allis-Chalmers Co. pfd.	52	50⅞	General Electric	175	169
American Tel. & Cable	90	90	Hudson River Tel.	..	..
American Tel. & Tel.	138	136	Interborough Rap Tran	204¾	199⅛
American Dist. Tel.	30	29	Metropolitan St. Ry.	116	114⅜
Brooklyn Rapid Transit	61⅝	57⅛	N. Y. & N. J. Tel.	..	..
Commercial Cable	..	..	Marconi Tel.	..	..
Electric Boat	30	30	Western Union Tel.	93	92
Electric Boat pfd.	73	73	Westinghouse com.	170¼	158
Electric Lead Reduction	..	..	Westinghouse pfd.	*94	..
Electric Vehicle	12	12			

BOSTON

	May 16	May 23		May 16	May 23
American Tel. & Tel	133¼	137	Western Tel. & Tel. pfd	68	68
Cumberland Telephone	119	118¾	Mexican Telephone	1¾	1⅝
Edison Elec. Illum.	*246	245	New England Telephone	137	*137
General Electric	176	168½	Mass. Elec. Ry.	16¼	16
Western Tel. & Tel.	17	*18	Mass. Elec. Ry. pfd.	61⅛	58

PHILADELPHIA

	May 16	May 23		May 16	May 23
American Railways	51	51	Phila. Traction	..	100¾
Elec. Storage Battery	79	77	Phila. Electric	11⅞	11¾
Elec. Storage Battery pfd.	..	..	Phila. Rapid Trans.	33¾	31⅞
Elec. Co. of America	12	11⅝			

CHICAGO

	May 16	May 23		May 16	May 23
Central Union Tel.	..	..	National Carbon pfd.	114	116
Chicago Edison	165	..	Metropolitan Elev. com.	21	22¼
Chicago City Ry.	..	190	Union Traction	..	..
Chicago Tel. Co.	..	134	Union Traction pfd.	..	..
National Carbon	60	85			

* Asked.

LEASE OF GAS PLANT.—It is stated from Philadelphia May 19, that "amid scenes of disorder unprecedented" in the annals of Philadelphia's legislative body, City Councils last evening voted to lease the city's gas works to the United Gas Improvement Company for a term of seventy-five years for the total sum of $25,000,000, the money to be paid in various amounts before the end of 1907. The lease appears to be a good thing for Philadelphia, although perhaps an even better deal might have been made. It seems also to carry public approval, leaving out of account the mob of two or three hundred people—or less—who object out of a million and a half.

STONE & WEBSTER EARNINGS.—Messrs. Stone & Webster report the earnings of the following companies for the month of March, 1905:

	1905.	1904.	Changes.	
Edison Elec. Ill. Co., of Brockton:				
March gross	$10,873	$9,153	Inc.	$1,720
Net	2,227	4,022	Dec.	1,795
Surplus	1,557	2,962	Dec.	1.405
Jacksonville Electric Co.:				
March gross	$27,596	$23,915	Inc.	$3,681
Net	12,246	9,335	Inc.	2,891
Surplus	* 9,229	6,259	Inc.	2,970
Lowell Electric Light Co.:				
March gross	$20,157	$19,916	Inc.	$241
Net	8,214	8,142	Inc.	72
Surplus	7,468	6,571	Inc.	897
Savannah Electric Co.:				
March gross	$44,554	$39,371	Inc.	$5,183
Net	17,106	14,560	Inc.	2,546
Surplus	6,552	4,526	Inc.	2,026
Houghton County Electric Light Co.:				
March gross	$16,225	$14,120	Inc.	$2,105
Net	8,370	6,205	Inc.	2,165
Surplus	6,182	4,017	Inc.	2,165
Minn. General Electric Co.:				
March gross	$62,309	$51,188	Inc.	$11,121
Net	34,816	22,824	Inc.	11,992
Surplus	24,727	13,273	Inc.	11,454
Tampa Electric Co.:				
March gross	$33,523	$29,901	Inc.	$3,622
Net	12,929	15,973	Dec.	3,044
Surplus	11,044	13,964	Dec.	2,920
Terre Haute Traction & Light Co.:				
March gross	$45,826	$42,024	Inc.	$3,802
Net	13,026	10,633	Inc.	2,393
Surplus	3,300	1,387	Inc.	1,913
Seattle Electric Co.:				
March gross	$194,203	$183,837	Inc.	$10,366
Net	58,495	53,766	Inc.	4,729
Surplus	33,633	30,224	Inc.	3,409

STREET RAILWAY PROPERTIES.—In a recent note on the magnitude of street railway work, the *Wall Street Journal* remarks: "Some conception of the immense business of the surface railroads of the State of New York is to be obtained from the last annual report of the State Railroad Commission. The steam railroads carry many passengers, but their chief revenue is from freight; the street railroads carry freight, but their chief revenue is from passengers. Their passenger traffic is simply enormous. The surface street railways in this State carried last year 1,341,766,931 passengers, an increase over the preceding year of about 74,000,000. Of this traffic, 312,860,257 represented transfers. The actual paid traffic was therefore a little in excess of 1,000,000,000. It is of interest to note that, while there was a total increase of 74,000,000 in the number of passengers carried, there was an increase of only 7,000,000 in the number of transfers. The gross earnings per passenger were 3.87 cents. The operating expenses per passenger were 2.34 cents. The net earnings were 1.53 cents. This computation is based upon the total earnings, including the receipts from freight, mail and so forth. It is clear from an analysis of the statistics given by the Railroad Commissioners that it would be impossible, on the present capitalization of the surface street railways, to reduce fares from 5 to 3 cents. Such a procedure would wipe out the dividends completely and not leave enough even to defray the interest upon the funded debt. A reduction of two cents in the passenger fare would leave only enough gross revenue to defray the operating expenses, and there would be only $2,748,000 of other income available to defray the $21,000,000 of interest, rentals and so forth. Even the abolition of transfers would not, under a three-cent fare system, yield enough revenue to make the operation of street railways profitable to their owners. Of course, this statement is made without regard to the question of whether the capitalization of the street railways is reasonable or not."

THE BELL IN INDIANA.—The recent acquisition of the United Telephone Company of Indiana by the Central Union (Bell) Telephone Company from Mr. Hugh Dougherty is exciting a great deal of comment among the independents. Mr. S. P. Sheerin, president of the Indianapolis Telephone Company, and the New Long-Distance Telephone Company, who has worked side by side with Mr. Dougherty in the great struggle, said the transaction was unlooked for and greatly chagrined and astonished him. "However, we are by no means cast down. This means that the independent people will put new plants where the Bell Company has bought out the independents," said he. Mr. Sheerin said he did not regard the situation at all alarming to the independent property in the State. A meeting of the men representing the independent interests in the territory surrounding the counties covered by the United Telephone Company was held in Indianapolis on the 18th and steps were taken to cover the field at once. W. L. Moellering and George W. Beers, of Fort Wayne, were among those attending the meeting. Mr. Beers said that the sale of the United Telephone Company would be only a temporary embarrassment, but would eventually result in good to the independent interests. Work will be begun at once to secure the necessary franchises.

ELECTRIC RAILWAY PROJECT FOR CUBA.—Interests identified with the Havana Electric Railway Company have in contemplation the construction of 120 miles of electric railway in Cuba, having Havana as a center. To carry out the project the Havana Ceneral Railroad has been organized under the laws of New Jersey, with a capital stock of $5,000,000. It is proposed to take over the rights already secured by the Insular Railway Company. To do this it is proposed to create a mortgage for $10,000,000, of which $5,000,000 will be issued at once, the remaining $5,000,000 to be retained in the treasury. These bonds will be drawn for 50 years, of the denomination of $1,000 each, and will bear interest at 5 per cent. A sinking fund will be begun in 1908 sufficient to retire the issue at maturity. In addition to the entrance to the city that the company will secure by the grant to the Insular Company, it will have access to Havana over the Havana Electric Railway, with which it has already entered into an operating agreement. The rights of the company are perpetual. The office of the company in New York is 52 Broadway.

DEVELOPMENT IN BRAZIL.—The *Wall Street Journal* says: "F. S. Pearson, who sailed from New York for Brussels three weeks ago, to secure, if possible, the control of the gas companies of Rio de Janeiro, which are owned in Brussels, for the Rio de Janeiro Light, Power & Tramway Company, cables that he has successfully closed the deal. All the lighting companies of the city will now be turned over to his company, which gives it a monopoly of the light, heat, power and street railway business in the Brazilian capital. One of the first steps will be the utilization of electricity in place of gas. At the present time there is no electricity in this city of over 800,000 inhabitants. It is understood that between $6,000,000 and $7,000,000 was paid for control of these foreign-owned gas companies. It is estimated that the lighting branch of the company's business will be good for earnings of $1,250,000 per annum."

THE MACKAY COMPANIES are to push further their work of organization. A meeting of the shareholders will be held at the office of the Mackay Companies, Ames Building, Boston, on June 15, to vote on the question of amending or altering the agreement and declaration of trust of the Mackay Companies as follows: Dividends shall be paid on January 1, April 1, July 1 and October 1, instead of on the 10th days of these months. The trustees shall be elected annually and shall be such number, not less than five, as the shareholders shall determine. Annual meetings for the election of trustees and for the transaction of other business shall be held the first of said meetings on the 12th day of July in the year 1905, and thereafter on the 15th day of February in each year. The idea is to place the trustees and investors in the companies nearer to each other, with a more flexible organization.

TRACTION SYNDICATE IN OHIO.—It is stated that a new holding company with a capital of $16,000,000, of which $8,500,000 will be preferred, is being organized to take over all of the properties in which the Cincinnati Traction Company is interested. This company will be known as the Union Traction Company of Ohio, and it takes the place of the Union Traction Company of New Jersey. There will be $2,000,000 of the preferred stock put on the market in the near future. This stock will be cumulative and will pay dividends of 5 per cent per annum. The formation of this company is said to be indicative of the passing of control of all of the Ohio interurban lines into the hands of the Widener, Elkins, Dolan, Schoepf syndicate.

MODEST TELEPHONE CAPITALIZATION.—The Great Eastern Telephone Company, with nominal headquarters at Huron, S. D., and a branch office for the transaction of business in New York City, has been incorporated and capitalized at $30,000,000. It comprehends a general telephone system, with messenger service. The incorporators are New York and Huron parties, the New Yorkers being Loyal Ward Reynolds, Stephen M. Conger, Eugene M. Brock, Henry N. McCay, John I. Wheaton, Edward Neuman and Elias J. Beach. The Huron incorporators are Philip Lawrence, M. M. Lawrence, Marion Hoke and L. S. Robbins.

TWIN CITY RAPID TRANSIT STOCK INCREASE.—The directors of the Twin City Rapid Transit Company have decided to submit to the stockholders of the company a plan for increasing the capital stock $5,000,000. A meeting of stockholders will be held in Elizabeth, N. J., May 31, to act upon the recommendation.

CUMBERLAND TELEPHONE.—The Cumberland Telephone & Telegraph Company reports April gross earnings at $381,909 and net at $144,994. The four months' surplus for the year is $536,054, being an increase of $54,143 over last year.

General News of the Week

The Telephone.

MOBILE, ALA.—The Baldwin County Telephone Company has about completed its new telephone line to Bon Secour and Shell Banks, and will lay a cable from Blakely to Mobile, where it will connect with the Southern Bell Telephone Exchange.

BISBEE, ARIZ.—The Gila Valley Telephone Company is considering the proposition of the Consolidated Telephone & Telegraph Company, to purchase the property and franchises of the Gila Valley Telephone Company.

STEPHENS, ARK.—The City Council has granted the Southwestern Telephone Company a 25-year franchise for a local telephone exchange.

CHEHALIS, CAL.—An ordinance has been passed by the council granting a franchise to the Chehalis & Boisfort Telephone Company.

ORANGE, CAL.—W. T. Porterfield has made application for a franchise to establish and maintain a telephone and telegraph system in the city.

LOMPOC, CAL.—The petition of the Union Oil Company for a franchise to lay a pipe line and maintain a telephone and telegraph line along the county road between Santa Maria and Guadalupe has been granted.

LOS ANGELES, CAL.—The Home Telephone Company has secured rights of way between here and Santa Ana for the long-distance service. Application for franchise rights in Oceanside will be made at the next meeting of the city trustees.

SMITH VALLEY, CAL.—A company consisting of Smith Valley and Wellington people has organized for the purpose of constructing a telephone line from Smith Valley to Carson City, and will be known as the Walker River Electric Company.

RIVERSIDE, CAL.—At a recent meeting of the Riverside Supervisors the Southwestern Home Telephone Company, having offered $500 for a franchise to erect and maintain telephone and telegraph lines on the highways of that county, the same was awarded.

LOS ANGELES, CAL.—Important extensions through Southern California are planned by the United States Long Distance Telephone Company of Los Angeles. The new points will be San Diego, Capistrano, Ocean Side, Pomona, San Bernardino, Covina, Monrovia, Redlands, Riverside and Long Beach.

SAN FRANCISCO, CAL.—The Home Telephone Company, of this city, has perfected its organization by electing the following officers: Mark L. Gerstle, president; Henry T. Scott, vice-president; Richard M. Hotaling, secretary, and J. S. Torrance, treasurer. A petition for a franchise will be filed soon. Engineer F. F. Graves says that the plans contemplate covering San Francisco from five stations, each connected with 12,000 telephones.

CHICAGO, ILL.—The Stark County Telephone Company has increased its capital from $6000 to $20,000.

SPRINGFIELD, ILL.—The Sangamon Telephone Company has increased its capital from $25,000 to $60,000.

ORION, ILL.—The Orion Telephone Association has been formed, capital $2000. The incorporators are F. L. Anderson, F. O. Swanson and others.

ROODHOUSE, ILL.—The Illinois Telephone Company has made arrangements to rebuild the company's lines between Roodhouse and Greenfield. About $15,000 will be expended on the improvements.

SIDNEY, ILL.—J. H. Culver, J. B. McMillen and V. E. Converse, of Decatur, have purchased the Sidney Home Telephone line at Sidney, Ill. They will reorganize the company's business and annex it to the Douglas County Telephone Company's line.

MONMOUTH, ILL.—The Secretary of State has issued a license to incorporate the Rural Telephone Construction Company of Monmouth. The capital stock is nominally $2000. The incorporators are Jesse E. Lanphere, William J. McQuiston and Reimer Lahann.

PLYMOUTH, IND.—Representatives of the Bell Telephone Company have appeared before the Common Council here, asking for a franchise to operate a plant in Plymouth.

ST. BERNICE, IND.—The Citizens' Mutual Telephone Company has been formed, capital $400. Directors: J. T. Newton, J. P. Hartsook, A. M. Reed, H. M. Nolan and V. P. Houston.

INDIANAPOLIS, IND.—The 5000 telephones controlled by the United Telephone Company will hereafter be operated in connection with those of the Central Union Telephone Company.

INDIANAPOLIS, IND.—Notice has been filed by the Farmers' Mutual Telephone Company, of Whitley County, of the increase of the capital stock of that company from $25,000 to $100,000.

NEEDMORE, IND.—The Needmore Telephone Company has increased its capital stock to $10,000 in order to extend the lines and install new apparatus. Joseph N. Fleener is president and W. A. Wellens, secretary.

MAQUOKETA, IA.—Otto Wettstein, of La Porte City, Ia., has bought the Maquoketa Telephone Company's plant.

BOONE, IA.—The Boone County Telephone Company plans extensive improvements to its system. About $25,000 is to be expended.

DES MOINES, IA.—The Walker Telephone & Telegraph Company of this city, capital $10,000, has been incorporated by William Trevor and others.

LEEDS, IA.—The Leeds Rural Telephone Company has been formed. C. I. Reid is president and Neil Hanson secretary and treasurer of the new company.

REINBECK, IA.—The Black Hawk & Grant Township Telephone Company has been formed with Fred Schreiber as president. No capital is named.

FONDA, IA.—The Northern Telephone Company with headquarters at Fonda and with 1400 miles of line, declared an 8 per cent. dividend at its annual meeting.

LAMONI, IA.—The Lamoni Telephone Company has been formed with $25,000 capital stock. President, W. A. Hopkins; vice-president, J. C. Danielson; secretary, Dr. W. J. Mather; treasurer, G. H. Derry.

WATERLOO, IA.—The United States Telegraph & Telephone Company has been sold at auction to Thos. Cascaden, Jr., of Waterloo, for the sum of $55,000. Mr. Cascaden represents the majority of bondholders.

FAIRFIELD, IA.—The annual business meeting of the Jefferson County Telephone Company has been held. Reports of officers and manager show a very satisfactory condition of affairs, with 859 telephones in use in city and county. J. C. Thorne was elected president, Ed. Hunt, vice-president; Frank Light, secretary and treasurer.

FRANKFORT, KY.—The Hauke & Folsom Telephone Company, of Grant County, capital $500, has filed articles of incorporation.

PORTLAND, ME.—The Champlain Valley Telephone Company has been formed, capital $150,000. President, F. W. Story, Boston; treasurer, C. H. Adams, Portland; clerk, Frederick Hale, Portland.

TOWSON, MD.—A certificate of the increase of the capital stock of the Union Telephone Company to $10,000 has been filed.

CHARLOTTE HALL, MD.—The stockholders of the Southern Maryland Telephone Company have elected the following officials and directors: J. F. Coad, president; J. B. Ballenger, vice-president; L. J. Canter, secretary and treasurer; Zachariah R. Morgan, George M. Thomas.

MORENCI, MICH.—The village council has granted a franchise to the Central Citizens' Telephone Association, of Medina, Mich.

MANKATO, MICH.—The Wayler Telephone Company has been formed, capital $50,000. The incorporators are E. J. P. Staede, Mankato; Charles Kinkele and others.

GLENVILLE, MINN.—The Freeborn County Rural Telephone Company has been incorporated with $10,00 capital.

ADA, MINN.—The Norman County Telephone Company has been reorganized and proposes to build a local exchange.

MINNEAPOLIS, MINN.—The Comfrey Rural Telephone Company has been formed; capital, $25,000. The president is J. A. Prim; secretary, C. L. Lundersmith.

MINNEAPOLIS, MINN.—The Sherburne County Telephone Company has been formed, capital stock $50,000; incorporators: J. C. Jacobson, George Patterson, Charles F. Knapp and Jesse A. Gutzler.

HAMILTON, MONT.—The Rocky Mountain Bell Telephone Company has been granted a franchise for an exchange in this city.

GLENDIVE, MONT.—Sealed proposals will be received at the office of the engineer of the United States Reclamation Service, Glendive, Mont., until June 1, for installing in connection with the Fort Buford reclamation project a telephone system having four telephone stations and about 70 miles of pole line.

MACON, MO.—The Macon Telephone Company has increased its capital from $15,000 to $50,000.

ST. LOUIS, MO.—Christopher O'Brien and Francis Washington, representing interests not made known, asked the County Court at Clayton, May 15, for a franchise to string wires and erect poles for a telephone system over the southern and western parts of the county. The petitioners agree to put in free telephones for the use of the county officers and to give the county the use of their poles for telegraph or fire alarm wires.

TONOPAH, NEV.—The Bullfrog-Goldfield & Las Vegas Telephone & Telegraph Company, organized by H. H. Clark and Key Pittman, has been granted a franchise by the county commissioners to operate its system in Nye county.

STERLING, N. Y.—Articles of incorporation of the Ne-Ah-Ga Telephone Company of this city have been filed with the County Clerk in Auburn.

HERKIMER, N. Y.—The application of the Central New York Telephone & Telegraph Company for a franchise to place wires underground in Herkimer has been granted.

ROCHESTER, N. Y.—Negotiations are in progress whereby the Rochester Telephone Company will acquire the recently organized Independent Securities Company. The capital stock was $800,000, but the company was authorized to make a mortgage of $15,000,000 to the Securities Trust Company of Rochester to secure a bond issue of equal amount that was to be used in the acquisition of other independent lines throughout the State. At the outset the new company obtained control of 250 stations and nearly 1000 miles of wires, including the Utica exchange and wires centering in that vicinity. The independent systems in these counties were all taken over: Otsego, Herkimer, Oneida, Lewis, Jefferson and Oswego.

ONEONTA, N. Y.—The Home Telephone Company has been incorporated with a capital stock of $50,000. The directors are W. B. Brown, A. W. Cutler and M. G. Keenan, Oneonta.

MALONE, N. Y.—The Adirondack Home Telephone Company has been incorporated to operate in Franklin, Clinton, St. Lawrence, Jefferson, Lewis and Essex Counties. The capital stock is $150,000, and the directors are Howard Hendrickson, W. A. Hendrickson and H. M. Keys, Albany.

DICKINSON, N. D.—The Dakota Telephone Company of this city has been formed, capital $20,000. The incorporators are W. P. Owen, W. G. Whinn and others of Dickinson.

HANNAFORD, N. D.—The Hannaford Telephone Company has consolidated with the Central North Dakota Co-operative Telephone Company, at Dazey, N. D. Mr. A. O. Anderson is secretary.

BROOKVILLE, OHIO.—The United Home Telephone Co., of Brookville, with a capital stock of $75,000, has been incorporated by N. W. Rinehart, A. M. Myers, John G. Kuhns, S. A. Blessing, O. E. Baker and H. B. Marshall.

TOLEDO, OHIO.—The Northwestern Ohio Toll Line Company has been absorbed by the Toledo Home Telephone Company. The Northwestern Company is a long-distance line running from Toledo to Defiance. It is stated that the purpose of the Toledo Company in acquiring the Northwestern property is to keep it from falling into the hands of hostile interests.

TOLEDO, OHIO.—During the construction season this year the United States Telephone Company will spend $225,000 on extensions of its lines into new territory. The plan has also been approved of putting in a direct wire between Cleveland and Toledo. Heretofore Cleveland and Toledo have been connected via Kent. When this is done the line will be extended east from Kent to Youngstown, where connection will be had with the line to Pittsburg. One of the most important movements which has just been arranged for by President Dickens and which will entail an outlay of $40,000 is to start at Columbus and run several long-distance wires through Circleville and Chillicothe to Portsmouth, and then up to Catlettsburg and Huntington, W. Va.

CAPTON, OKLA.—The Driftwood Telephone Company has been incorporated with a capital of $1000. The incorporators are John Nelson and William Lightburn.

GRANTON, OKLA.—The Granton, Fairview & Western Telephone Company has been formed, capital $5,000. The incorporators are J. C. Major, W. G. Scates and others.

SALEM, ORE.—The Spring Valley Telephone Company has been formed; capital $1000. Incorporators: C. W. Sherman, W. L. Welch and Theodore Flackus.

PITTSBURG, PA.—The Federal Telephone Company has issued the following notice to its subscribers: "Owing to the destructive competitive methods inaugurated by the P. & A. in McKeesport, we desire to close our exchange in that city on June 30, and retire from business in that locality only."

JEFFERSON, PA.—A deal has been closed whereby the interests of the Monongahela Valley Telephone Company passed into the hands of the Tri-State Telephone Company.

KIRKWOOD, PA.—The annual meeting of the stockholders of the Southern Telephone Company has been held at Kirkwood. The reports of the officers showed that the company had done a prosperous business during the past year. The board organized by choosing Mr. Cutler president, Mr. Greenleaf vice-president, Mr. Blair secretary, and Mr. Swisher treasurer.

MEADVILLE, PA.—Representatives of independent telephone companies of Western Pennsylvania have organized the Western Pennsylvania Independent Telephone Company. Twenty-two telephone companies were represented, including Pittsburg, Cleveland, Buffalo, Erie and other concerns. These officers were elected: President, Frank Hart, of the Pittsburg & Allegeny Telephone Company, Pittsburg; secretary, H. B. Mitchell, Emlenton; treasurer, John H. Wright, Jamestown, N. Y. Contracts have been let for additional wires between Meadville and Pittsburg and Meadville and Cleveland.

KILLER, S. D.—Waite & Halbower have been granted a telephone franchise.

PLANKINGTON, S. D.—The Firesteel Telephone Company of this city has been incorporated by J. D. Donegan, W. A. Noland and others. Capital, $20,000.

EUPORA, TENN.—The Co-operative Telephone & Telegraph Company has been incorporated with a capital of $5,000.

FENTRESS COUNTY, TENN.—The Central Telephone Company of this county has been formed, with a capital of $10,000.

SMILEY, TEX.—The Billings Telephone Company has been organized at Smiley. The main line will be run from this township to Elm City, Karnes County, and other extensions will be made to DeWitt County. The stock is all owned by home people and Mr. Hassell is manager.

SALT LAKE CITY, UTAH.—Improvements to the amount of $20,000 will be made shortly in the operating department of the Rocky Mountain Bell Telephone Company's system here.

AUSTIN, TEX.—At the annual meeting of the board of directors of the Texas Telephone & Telegraph Company the following officers were elected: President and general manager, C. C. Gibbs, of San Antonio; vice-president, W. R. Hamby, of Austin; superintendent, A. G. Miller, of Llano. The directors authorized the construction of important extensions. This company is now extending its system to Brady and Georgetown, and recently completed extensions to Castell and other places. Its lines now aggregate 700 miles.

GILLIARD, VA.—A charter has been issued for the Mt. Gilliard Telephone & Electric Light Company, of Gilliard, Montgomery County. The capital is $25,000 and the principal incorporators are J. R. Blair, A. H. Ragan and E. M. Harris.

COFFEE, VA.—The Bedford & Campbell Telephone & Telegraph Company will build ten miles of line in the near future. The company was recently organized. Dr. F. W. Nelson is president, and B. D. Clay secretary and treasurer.

SEATTLE, WASH.—E. E. Webster, of the Independent Telephone Company, has applied for a franchise in Tacoma for a local exchange.

BLOOMINGDALE, WIS.—The Buckeye Ridge Co-operative Telephone Company of this city has been formed with a capital of $1500. The incorporators are S. W. Mosshold, Isaac Post and others.

VANCOUVER, B. C.—Centrally located property has been bought by the British Columbia Telephone Company for the purpose of erecting a large building in which to permanently install its exchange. If the company is permitted to lay wires under ground, about $250,000 will be spent on the building and improving the system.

Electric Light and Power.

VISALIA, CAL.—Bids will be received until June 5 for an electric franchise. Eugene L. Scott is county clerk.

VENTURA, CAL.—Bids are about to be asked for the purchase of $125,000 bonds to be used for the construction of water works and an electric light plant.

SAN FRANCISCO, CAL.—A sub-station is being constructed at Hammon, ten miles east of Marysville, Cal., where gold dredging operations are now under way and a number of new dredges will be installed by John Martin and other officers of the California Gas & Electric Corporation. It is understood that electric power will be distributed for dredging and electric railway purposes.

CEDAR HILL, CONN.—The new plant to be erected by the National Folding Box & Paper Company at Cedar Hill, the work on which has been started, will cost $150,000. In the centre of the court will be a power station of concrete construction, which will contain an electric power plant of from 300 to 500 horsepower. From this plant power will be distributed by a direct-drive system to all parts of the mill, the lights also being furnished from the same plant.

WILMINGTON, DEL.—Mayor Bird has suggested to the Water Commissioners the advisability of constructing an electric light plant to light the reservoirs and park lands and eventually to light the city.

MONTICELLO, FLA.—The Monticello Power Company has been incorporated with a capital of $10,000. The incorporators are John M. Henry, John M. Hay, jr., and S. M. Conant.

FORT VALLEY, GA.—Bonds to the amount of $12,000 have been sold for the construction of an electric light plant.

SAVANNAH, GA.—The Savannah Lighting Company will petition the City Council to be allowed to erect poles and conduits within the city limits and in the streets and lanes. J. J. Cummings is president, L. McNeill, vice-president, and William Ellis, secretary. The petition of the company recites the fact that it will furnish the very best up-to-date lights and at a material reduction in price.

HAILEY, IDAHO.—The Cramer Electric Company has decided to purchase the plant of the Idaho Electric Supply Company and will furnish light for Hailey and Bellevue. A new plant will probably be installed.

SPRINGFIELD, ILL.—The Springfield Light, Heat & Power Company has increased its capital from $175,000 to $325,000.

EAST ST. LOUIS, ILL.—At the meeting of the city council May 15, the St. Clair Light & Power Company accepted the ordinance granted to it last month to erect poles, stretch wires and erect a power house in East St. Louis for the purpose of furnishing electric current for light and power.

ELWOOD, IND.—The Elwood Electric Light Company has amended its articles of incorporation so as to permit of the construction and operation of a heating plant in connection with the lighting plant, for public and private consumption.

SIOUX CITY, IA.—The Sioux City Gas & Electric Company will expend about $100,000 in improvements.

SHREVEPORT, LA.—An election will be held in August to vote on issuing $150,000 bonds for the construction of a municipal electric light plant. W. R. Thomas is city secretary.

BANGOR, ME.—Prominent contractors from various parts of New England have beeen examining the great water-power privilege at Livermore Falls, owned by the International Paper Company, and making plans for its immediate development. The International Paper Company will expend about $600,000 to develop the privilege and erect a large pulp mill. The company will soon begin work on a large sulphite mill at Chisholm, which means an expenditure of several hundred thousand dollars and the employment of a large crew of men for at least a year.

FALL RIVER, MASS.—At a special meeting of the stockholders of the Fall River Electric Light Company it was voted to increase the capital stock from $350,000 to $600,000. The increase is to provide funds for constructing a new generating plant on the company's new wharf at the foot of Taylor street. If the State board approves the increase they will also fix the price per share at which the stock is to be issued.

CHARLESTOWN, MASS.—Plans for a central building to furnish power for the entire system of the Charlestown Navy Yard have been completed and will be submitted to Washington soon. The plans are the result of an investigation made of the different navy yards by Stone & Webster, who were appointed by the Navy Department under the directions of the yards and docks department, and it is stated that they recommended that the Boston yard's installation of this new central plant will cost in the neighborhood of $250,000.

NANTUCKET, MASS.—Under a decree of Judge Sheldon of the Superior Court, Charles Neal Barney, of Lynn, the receiver for the Nantucket Gas & Electric Light Company, has transferred the property of the concern to the new corporation which has been organized under the name of the Citizens' Gas, Electric & Power Company of Nantucket. The officers of the new corporation are: President, Sidney Chase, of Boston; treasurer and general manager, William F. Codd; clerk, Roland B. Hussey; directors, Sidney Chase, William F. Codd, John C. Ring, Albert G. Brock, Franklin Folger, George F. Mitchell, R. E. Congdon, John H. Gronard, R. B. Hussey. The board has selected Ralph W. Coleman of Andover as superintendent of the electrical plant.

MENOMINEE, MICH.—It is proposed to develop the water power of Menominee River at a probable cost of $250,000, but nothing definite has yet been done. N. M. Edwards, of Appleton, is the engineer.

AITKIN, MINN.—It is stated that the Aitkin Power & Light Company will construct a water power plant at a cost of $20,000.

SOUTH ST. PAUL, MINN.—The City Council has granted A. Baumgarten, John Coates and others a franchise for an elecetric light plant to cost about $15,000.

MOORHEAD, MINN.—The Westinghouse Machine Company has secured the contract for a turbine, generator, condensing apparatus, switchboard, etc., to be erected here complete, for $18,750.

ST. LOUIS, MO.—The General Service & Development Company filed a petition with the County Court asking for a franchise to construct a line of wires in the county for the purpose of supplying electric light and power. The petitioners offer to pay into the county treasury $500 if the franchise is granted.

WISNER, NEB.—The citizens have voted to issue $9000 bonds for a municipal lighting plant.

SWEDESBORO, N. J.—The Swedesboro Gas & Electric Company has been sold out under sheriff's sale to Mr. J. T. Sickler for $860 subject to a mortgage in the sum of $35,000.

ALBANY, N. Y.—The Buffalo & Niagara Falls Electric Light & Power Company has filed with the secretary of state a certificate of increase of capital stock from $500,000 to $2,500,000.

ALBANY, N. Y.—The Atlantic Light & Power Company has been formed; capital, $200,000. Incorporators. Howard Hendrickson, William A. Hendrickson, James E. Carhart, all of Albany.

ALBANY, N. Y.—The Buffalo & Niagara Falls Electric Light & Power Company has filed with the Secretary of State a certificate of increase of capital stock from $500,000 to $2,500,000.

SYRACUSE, N. Y.—The Northern Power Company, of Syracuse, has been incorporated to furnish electricity in Franklin, St. Lawrence, Jefferson, Oneida, Oswego and Onondaga counties, with a capital stock of $100,000. The directors of the company are W. B. Cogswell and E. J. Page, Syracuse, and E. A. Merritt, Jr., Potsdam.

NEW YORK, N. Y.—The State Public Service Company, Queens Borough, New York City, has been incorporated to manufacture gas and electricity. The capital stock is $50,000, and the directors are John Mason and Salvatore Ofria, Queens Borough, and J. W. Goodman, Nogales, Ariz.

NEW YORK, N. Y.—The New York Public Service Company, of Queens Borough, New York City, has been incorporated to manufacture gas and electricity, with a capital stock of $50,000. The directors are J. A. Murray and Walter Webb, New York, and J. J. Flynn, Providence.

TROY, N. Y.—The Rensselaer Heat, Light & Power Company, of Troy, N. Y., has been incorporated with a capital stock of $5000. The directors are Edward J. McKenna and Lewis Griffith, Troy, and E. L. Worden, Hoosick Falls.

WHITE PLAINS, N. Y.—The Homans Light, Heat & Power Company, of White Plains, has been incorporated with a capital stock of $50,000, to supply gas, electricity and steam throughout the State. The directors are R. B. Martin, W. P. Homans and M. S. Watts, New York.

POTSDAM, N. Y.—The Northern Power Company has been incorporated with a capital of $100,000, by C. H. Tappen, of Potsdam, and others. This is a reorganization of the Hanawa Falls Water Power Company, which has a plant on Racquette River at Potsdam.

HOOSICK FALLS, N. Y.—The Hoosick Falls Illuminating Company has been incorporated with a capital of $150,000. The directors are Roger Lewis, Louis C. Tetard, Sherman Cox and Ralph W. Gifford, of New York, and George D. Martin, of Greenwich, Conn.

CHATHAM, N. Y.—The Lindenwald Light, Heat & Power Company has been incorporated, capitalized at $250,000, with principal office in Chatham, Columbia County. The directors are Aaron B. Gardenier, Sanford W. Smith and M. P. H. Smith, all of Chatham, Columbia County.

NIAGARA FALLS, N. Y.—The International Power & Transmission Company, of Niagara Falls, has been incorporated with a capital of $2,000,000. The directors are S. P. Franchot, James S. Emmons, Frederick T. Brown, Clarence Tower, John F. Lynch and Henry H. Findlay, all of Niagara Falls.

BURLINGTON, N. C.—The citizens have voted to issue $10,000 bonds for improving the electric light plant.

WILSON, N. C.—L. S. Randolph, Blacksburg, Vt., has been selected to prepare plans, specifications and estimates for a gas power plant and electrical distribution of same.

YOUNGSTOWN, OHIO.—The Youngstown Gas & Electric Company is preparing plans for enlarging the power plant on North Avenue.

ASHLAND, OHIO.—This city was in darkness on the night of May 8 as the result of a failure to secure a renewal of the lighting contract between the Ashland Gas & Electric Light Company and the city. The contract expired on May 1, and notwithstanding the company's efforts to secure a renewal the Council neglected to take the necessary action. The company notified the Council that it would shut off the service. A special meeting of the Council was called to consider the matter.

WYNNEWOOD, OKLA.—The city will probably let a franchise for an electric light plant.

PRAIRIE GROVE, ORE.—C. L. Cummings & Son are ready to receive bids for the construction of an electric light plant, to cost from $2000 to $3000.

WASCO, ORE.—The Wasco Milling Company proposes to construct an electric light and power plant, to cost from $35,000 to $40,000. A. M. Mohr, The Dalles, is engineer. The plant will be located about 13 miles east of Wasco on John Day River.

HAWLEY, PA.—The plant of the Hawley Electric Company was destroyed by fire May 13.

WILKESBARRE, PA.—The directors of the Wyoming Valley Gas & Electric Company have recommended an expenditure for the equipment for the power houses and for other machinery.

SELINSGROVE, PA.—Geo. W. Wagenseller, of Middleburg, secretary Middlecreek Electric Company, writes that the date of opening of bids for constructing a complete water-power electric plant on Middlecreek and Pennscreek, 2 miles south of Selinsgrove, has been extended from June 1 to about June 15. Bids can be made on part or all of work.

WILKESBARRE, PA.—The Wilkesbarre Gas & Electric Company has placed an order with Allis-Chalmers Company, of Milwaukee, for one horizontal cross compound Reynolds-Corliss condensing engine, with cylinders 22-in. and 40-in. in diameter and a 42-in. stroke, for direct connection to a 500-kw, 60-cycle, 2300-volt, alternating current generator. It will be designed to run in parallel with a Vulcan engine already installed, which will be rebuilt by Alis-Chalmers Company.

ABERDEEN, S. D.—Bonds to the amount of $40,000 have been sold, to be used for the construction of an electric light plant.

DEADWOOD, S. D.—The Lead and Deadwood electric light companies have been consolidated and will expend about $1,000,000 in the installation of new machinery and building transmission lines. A power plant will also be constructed at Pluma. N. E. Franklin, of Deadwood, is interested.

GALVESTON, TEX.—The Galveston Electric Company, recently incorporated, will take over the Galveston City Railway Company. No changes in the management are contemplated. The Galveston Company operates 35 miles of line in the city, and furnishes power for lighting.

EPHRAIM, UTAH.—The city council has under consideration the installation here of an electric power plant.

COALVILLE, UTAH.—An election will probably soon be held to vote on issuing $10,000 bonds for the construction of an electric light plant.

PERRY, UTAH.—The Perry Electric Light & Power Company has filed articles of incorporation with the secretary of state. The company is capitalized for $20,000

RICHMOND, VA.—E. W. Trafford, recently appointed by the city to report on the matter of a municipal electric light plant, has completed his report, and estimates the cost of a plant at $400,000. Mr. Dabney is chairman of the lighting committee.

GREEN BAY, WIS.—The Green Bay Gas & Electric Company has been formed by Messrs. W. Mainland, of Oshkosh, and Messrs. S. Mainland and R. Burton, of Green Bay, with a capital stock of $750,000. It is a reorganization of the Green Bay Light & Power Company.

MAGDALENA, MEX.—The electric power plant of the Black Mountain Mining Company, at Magdalena, is to be enlarged. The company will furnish power for factories in Magdalena and may also install an electric plant for the purpose of supplying the city with power and lights.

OTTAWA, ONT.—The citizens have voted to purchase the plant of the Consumers Electric Company at a cost of $200,000.

The Electric Railway.

NEW YORK, N. Y.—It is stated that the executive committee of the Construction Company which will build the Port Chester Railroad, will expend most of the $1,000,000 called for by the board of directors in the purchase of rights of way and real estate for sites. Another call for $1,000,000 will be made about July.

CANTON, OHIO.—The Canton-Akron Railway Company is installing in its main power station a 2000-kw Curtis turbo-generator. This will bring the capacity of the station up to 3800 kilowatts—sufficient to take care of its requirements for a long time to come. It is expected that the generator will be in operation before July 1.

CLEVELAND, OHIO.—Mayor Johnson has submitted a proposition to the Cleveland Electric Railway Company looking to the taking over of the street railways by a holding company, with a selling price fixed in the lease at which the city may buy within a period of 25 years. The Mayor's proposition is on the basis of a selling price equal to the recent market value of the company's stock, which is now selling for about 78. It has recently sold as high as 85. It is known that the Mayor will make the price as high as 90. From Mayor Johnson's point of view, the physical and franchise value of the Cleveland Electric Railway Company is about $9,250,000. The Mayor also believes that the settlement along the line he has suggested would be worth $1,000,000 a year to the people of Cleveland.

HARRISBURG, PA.—A. J. Barron, of Pittsburg, is president of three street railway companies which have received charters at the State Department to operate in Allegheny County, as follows: The Carnegie & Rennerdale Co., which will construct four miles of road from Carnegie to Rennerdale, with a capital of $24,000; the Oakdale & McDonald Street Railway Company, $21,000 capital, will build three and one-half miles of road around Oakdale, and the Rennerdale & Oakdale Street Railway Company, which will operate three miles of road between Rennerdale and Oakdale.

PROVIDENCE, R. I.—The prospects for an electric railway from Watch Hill to Narragansett Pier are very promising. Representative A. B. Crafts is interested.

COLUMBIA, S. C.—The Columbia Electric Street Railway Light & Power Company has decided to acquire by purchase the plant of the Columbia Water Power Company. It is proposed to construct a steam turbine auxiliary power plant at a cost of about $300,000. Edwin W. Roberston, of Columbia, will probably be president.

CLARKSVILLE, TENN.—A deed has been recorded here transferring the property of the Queen City Electric Light & Power Company to the Clarks-

ville Street Railway Company. By this transfer the two companies are consolidated. It is the purpose of the company now to issue bonds to pay all debts of the company, improve the present system and extend the street car line and electric lights to New Providence, and also to Dunbar's Cave and Guthrie, Ky.

BRYAN, TEX.—A franchise for an electric street railway system has been granted to J. R. Astin and others. An electric light plant will also be erected and operated by the same company.

HAMILTON, TEX.—S. S. Wright, one of the directors of the Municipal Bond & Trust Company, has closed a contract to build a trolley line from Dublin in Erath County to Hamilton.

AUSTIN, TEX.—A charter has been granted to the San Marcos Valley Interurban Railway with a capital of $500,000. The incorporators are J. W. Scott, of St. Louis, Mo., and A. T. Fisher, of Boston, Mass.

DUBLIN, TEX.—Mr. Eugene Moore, of Stephenville, Tex., says an interurban electric railway has been contracted for to be built from the town of Dublin to Hamilton, in Hamilton county, a distance of 35 miles.

AUSTIN, TEX.—A company is being organized by Eastern capitalists for the purpose of constructing an interurban electric road from this place to Lockhart, a distance of 32 miles. Charles W. Ohrndorf, of St. Louis, Mo., is one of those interested.

GALVESTON, TEX.—The Galveston Electric Company has been organized here with a capital stock of $2,000,000. It is a Stone & Webster corporation, formed primarily to take over and operate the existing street railway system of Galveston. It is reported that the company will also build an interurban line between Galveston and Houston, a distance of 51 miles, but this report is not confirmed. The incorporators are C. A. Stone, E. S. Webster and G. E. Tripp, all of Boston, Mass.; M. M. Phinney, of Dallas; Edwin B. Parker, A. W. Q. Birtwell, of Houston; John Sealy, Sealy Hutchins, Walter C. Ansell, Ed. Cavin, E. M. Robertson, R. B. Wilkins and Ballinger Mills, of Galveston.

CHARLOTTE COURT HOUSE, VA.—The Appomattox & Charlotte Railway Company, of Charlotte Courthouse, has been incorporated by B. P. Eggleston, president, Drake's Branch; S. L. Ferguson, vice-president and secretary, West Appomattox, to construct, operate and maintain a railway from Appomattox to Drake's Branch, Va. The capital stock is $5,000, but the motive power is not specified.

STAUNTON, VA.—The Virginia Valley Traction Company has been incorporated with a capital stock of $25,000. The officers are: President, H. B. Sproul, Staunton; vice-president, J. Frank Clemmer, Middlebrook; secretary and treasurer, H. G. McGary, Middlebrook.

TORREON, MEX.—W. T. McGraw and A. B. Bennett, of Detroit, Mich., and W. H. Blocher, of St. Louis, Mo., are negotiating for the purchase of the electric light plant and the city electric street railway system of Torreon.

New Industrial Companies.

THE RAPID ELECTRIC HEATER COMPANY, of San Francisco, has been formed by K. C. Hamilton, R. W. Baranoff and others; capital, $25,000.

THE NATIONAL TELEPHONE TABLET HOLDER COMPANY, of Boston, has been formed; capital, $40,000; president, Fred. A. Ewell; treasurer, Charles F. David.

THE KNICKERBOCKER FRICTION DRIVE AUTOMOBILE COMPANY, of Worcester, Mass., has been formed; capital, $50,000; president, James Dorr; treasurer, James F. Dorr.

THE NATIONAL LIGHT AND IMPROVEMENT COMPANY, of Jersey City, has been formed; capital, $2,000,000. Incorporators: Henry C. Scitt, Louis B. Dailey, and Thomas F. Barrett.

THE LUBRICATION-PACKING MOTOR COMPANY, of Camden, N. J., has been formed; capital, $100,000. Incorporators: Jacob A. Leathy, Frederick Banzhef, Gustave J. Scheflen, James B. Given, all Camden.

THE UNITED AUTOMATIC LIGHTING COMPANY has been formed in Malden, Mass., to deal in lighting systems, etc.; capital, $100,000. President, Geo. W. Faulkner, Cambridge; treasurer, Harris B. Mitchell, Malden.

THE NICHOLAS QUADRILLE TRACTION VEHICLE AND POWER COMPANY, of Mt. Vernon, N. Y., has been formed; capital, $300,000. Directors, W. S. Harper, Brooklyn, and J. F. Bissell and D. O. L. Cohalan, New York.

THE EVANSVILLE BATTERY & ELECTRICAL COMPANY, of Evansville, Ind., has filed articles of incorporation with a capital of $100,000. The object of the corporation is to manufacture and deal in automobiles and other vehicles propelled by electricity, and to manufacture and deal in electric storage batteries and other electrical devices and machines. Willis M. Copeland, A. F. Korges and H. C. Porter are directors.

Legal.

MOTOR LITIGATION.—Suit has been brought in the United States Circuit Court at St. Louis by the Wagner Electric Manufacturing Company, the St. Louis Union Trust Company and Albert Blair, plaintiff, against the Century Electric Company and Edwin S. Pillsbury, vice-president and general manager of the latter concern, for alleged violation of patent rights in the manufacture and sale of an electric motor.

INJUNCTION ON WIRELESS SUSPENDED.—Judge Townsend, in the United States Circuit Court, New York, has granted the motion of Philip Farnsworth, counsel for the American De Forest Wireless Telegraph Company, suspending the injunction recently granted on the ground of infringement in favor of the Marconi Wireless Telegraph Company, pending a final hearing of the case. Details have already been given in our pages.

INFRINGEMENT OF REFLECTORS.—In a decision handed down by Judge Ray, in the Circuit Court of the United States, Southern District of New York, in the suit of Otis A. Mygatt vs. Edmund L. Zalinsky and The Illuminating Engineering Company for alleged infringement of Holophane prismatic reflectors, the validity of the Mygatt patent was fully sustained, and the reflectors manufactured by the Illuminating Engineering Company held to be an infringement. A permanent injunction and accounting was ordered. The patent on which suit was brought covered the well-known prismatic reflector which has been manufactured and sold by the Holophane Glass Company for the past five years. It was contended by Zalinsky that the Mygatt patent was invalid, and also that his reflector was sufficiently different not to infringe. Both contentions, however, were denied by the Court, which said that the slight changes noticeable appeared to be made to be used in justifying the infringement if possible. The defendants' shades or reflectors were bald appropriations of the complainant's patent. Slight changes are made which add nothing to the ornamentation, but rather detract therefrom. "They (the defendants) say, 'We may use the frustum of the cone shape, we may use a circular collar with an opening, we may use a smooth inside face, we may use the prismatic ribs; we may have them long or short as we elect; therefore we may use them in the combination indicated by the complainant's patent.' This can not be so if any design patent is to be held valid. The Court is of the opinion that the patent is valid and that defendants infringed."

Obituary.

THE LATE G. W. DAVENPORT.

MR. G. W. DAVENPORT.—We record with deep regret the sudden death, under an operation for appendicitis, of Mr. George W. Davenport, third vice-president of the Niagara Falls Power Company. He was born at Fall River, Mass., about 47 years ago. After a course in the Massachusetts Institute of Technology, and factory experience with the Thomson-Houston Electric Company, at Lynn, Mass., he became general manager of the Thomson-Houston International Company, and for eight years was connected with that company and the General Electric Company. When the General Electric Company, in 1893, turned over to a board of trustees, known as the trustees of Street Railway and Illuminating Properties, over ten millions of securities of various electric lighting and railway companies situated in different parts of the United States, Mr. Davenport became assistant to the trustees, and had a varied experience in the examination, operation and management of many of the 136 properties in which the trustees were interested. He became later second vice-president of the Planter's Compress Company, whose had office is in Boston. He went to Niagara Falls about 18 months ago. As an associate of Mr. C. A. Coffin in the old Thomson-Houston days and latterly as expert and manager in connection with electric light and power properties, Mr. Davenport made a great success, being also one of the most widely-known men in the central station field. He was a man of marked personality, charming manners and not only conversant with affairs, but a deeply read student, one of his hobbies being the collection of old books and early electrical literature. He was a member of the Exchange and University clubs of Boston, the Country Club and Calumet Club of Winchester, and an associate member of the American Institute of Electrical Engineers. A widow and two young daughters survive. The funeral took place Sunday in Fall River.

Educational.

ADAMS APPARATUS AT COLUMBIA.—In connection with the recent research endowment of $50,000 at Columbia University, in memory of Ernest Kempton Adams, his father, Mr. E. D. Adams, carrying out his desires, turned over to the University, especially to the departments of electrical engineering, psychology and physics, all of the instruments and apparatus which his son had collected, and they are now mounted in the laboratories, and form a very important contribution to the equipment. Some of the more important pieces are the following: A very large conical pendulum chronoscope for psychological work; two different forms of apparatus for plotting the boundaries of the "blind spot" in the eye, together with a considerable amount of apparatus for experimental psychology. In electrical engineering there are a number of small motors and generators of special construction, resistance boxes, bridges, galvanometers, etc. In the physical laboratories they were fortunate enough to obtain a 50 centimeter linear dividing engine and a 20 centimeter circular dividing engine, both of the most complete pattern made by the Geneva Society; also a very complete cathetometer, made by the same company; a standard meter bar, calculating machine, a standard clock, a collection of bars of "invar," and a standard laboratory barometer; and a number of other smaller pieces; the whole collection being very acceptable. As already noted the first appointment under the research fund is Prof. E. F. Nichols, who is now at Cambridge University, England, but will return to Columbia in the fall and follow up a special investigation of the relations between magnetism and electrostatic fields.

Personal.

MR. W. OWEN THOMAS.

MR. W. OWEN THOMAS has opened an office as consulting electrical mechanical engineer at 645 First National Bank Building, Chicago. Recently Mr. Thomas has been assistant mechanical engineer of the Chicago & Northwestern Railroad, and previous to that was electrical engineer of the Sault Ste. Marie water power plant of the Lake Superior Power Company. Among his work in connection with this plant was the design of the switch board in a space of 12 square feet, from which some 40 hydro-electric units are to be controlled. Mr. Thomas also for a time had charge of the company's electrical work, including electric light and street railway service on the American side and the Canadian plant supplying the pulp and steel mills with power. Mr. Thomas will retain his connection in a consulting capacity with the C. & N. W. Railroad, and also with the Lake Superior Company. Mr. Thomas, who is 32 years old, was educated at the Central London Foundation School and at Cambridge. His first engineering experience was with Mr. A. Eustace Haversham and Mr. Gordon L. Stevenson. He came to this country eight years ago and entered the employ of Mr. D. H. Burnham, and later was one of the engineering staff of Mr. B. J. Arnold, from which position he went to the Soo plant.

MR. W. S. BARSTOW, consulting engineer, 56 Pine Street, New York, has just returned from an extended trip on the Pacific Coast.

MR. W. E. GAVIT, of the Tucker Electric Construction Company, New York City, has been seriously ill, giving concern to a host of friends.

MR. LOUIS B. MARKS has been retained as illuminating engineer by the College of the City of New York. He has also been retained by several private concerns for similar work.

MR. CARL C. CURTIS has resigned as manager of the Sandusky, Ohio, Telephone Company, and has gone to Columbus as manager of the long-distance business of the United States Telephone Company.

MR. HERBERT LAWS WEBB, the consulting telephone engineer, of London, who was recently in Spain, is now visiting this country and was in New York during the present week. He is also visiting Canada.

MR .C. O. POOLE, consulting engineer for the Nevada Power, Mining & Milling Company, has returned from San Francisco to Denver, where he is connected with a firm holding the district agency of the Stanley Electric Manufacturing Company.

MR. LEONARD ANDREWS, E. E., managing director of the Key Engineering Company, of Manchester, England, is about to visit this country again and is expected about June 5. He has recently brought out an excellent book on "Electric Switch Gear."

PROF. J. C. KELSEY, chief of the department of telephone engineering, at Purdue University, has resigned to accept a position as sales engineer with a Chicago telephone manufacturing company. Prof. Kelsey went to Purdue three years ago from Minneapolis, Minn.

MR. W. W. DONALDSON, who has been ill for the past six months with nervous prostration, has retired from the Gould Storage Battery Company, with which he had been prominently connected for some years in New York City. He is going to Baltimore to spend the summer recuperating.

DR. M. I. PUPIN, of Columbia University, has been elected a member of the National Academy of Sciences, in recognition of his work as a physicist and inventor, of international reputation. In this respect he may be classed with Prof. A. G. Bell, also a member of the Academy, and an inventor in the field of telephony.

MR. GANSEY R. JOHNSTON, secretary of the American District Telegraph Company, has been selected as general manager of the Citizens' Telephone Company, of Columbus, Ohio, to succeed Frank L. Beam, who recently resigned to devote his whole time to the duties of president of the Ohio Independent Telephone Association.

MR. HOMER F. NIECZ, of the Chicago Edison Company, and editor of the N. E. L. A. "Question Box" for the Denver Convention, has been at headquarters in New York City for the past week cleaning up a vast amount of work in connection with that valuable part of the programme. The "Box" this year is, if anything, more interesting than ever, and full of good things.

MR. WALTER M. McFARLAND, acting vice-president of the Westinghouse Electric & Manufacturing Company, has sustained an irreparable loss in the death of his mother, Mrs. Sarah J. McFarland, at Pittsburg, on May 11. Interment was at Washington, D. C., which city was Mrs. McFarland's home for more than 50 years prior to her Pittsburg residence of the past six years. She was 73 years of age.

MR. ARTHUR WARREN, manager of publicity for Allis-Chalmers Company, whose recent addresses before the American Trade Press Association in New York and the Chicago Trade Press Association have attracted so much attention throughout the country, was the speaker of the evening at the annual dinner of the Manufacturers' Advertising Club in Cleveland on Tuesday evening, May 9. Mr. Ambrose Swasey, who was last year's president of the American Society of Mechanical Engineers, and is this year's president of the Cleveland Chamber of Commerce, spoke on the same occasion and strongly indorsed the position which Mr. Warren has taken, and congratulated the Manufacturers' Advertising Club upon the success of its first year and a half of existence and the usefulness of its work. The organization is the only one of its kind, but if Mr. Warren's suggestion is followed there will soon be similar bodies in other manufacturing cities. The object of the club is to promote the art, or, as some say, the science of publicity as an aid to manufactures. Membership is strictly confined to representatives of industrial establishments in the mechanical lines. The purpose is to bring together the publicity managers, sales managers, and executive heads of such establishments in the interests of publicity work, and they alone are eligible for membership.

MR. H. J. SLIFER.—J. G. White & Company, Incorporated, announces that it has secured Mr. H. J. Slifer as steam railway expert. Mr. Slifer was born in 1859 and graduated from the Polytechnic College of Pennsylvania in 1880 with the degree of Mining Engineer. Since that time he has been constantly engaged in railway work of a nature to qualify him well for the position he now holds. From 1880 to 1882 he was with the Mexican National Railway and advanced from rodman to engineer in charge of construction. In 1882 he was made assistant engineer in charge of maintenance on the Philadelphia division of the Pennsylvania Railroad, and during the following nine years supervised its tracks, bridges, buildings, etc. His work included the replacing of a number of bridges and the moving of several bridges bodily to new locations. From 1891 to 1893 Mr. Slifer filled the position of assistant chief engineer of the Milwaukee-Lake Shore & Western R. R., and upon its being merged with the Chicago & Northwestern he was made engineer of the Ashland division. He held this position until 1897, and during this time designed and constructed a large amount of dockage. From 1897 to 1899 he was in charge of the construction of double track in Iowa for the Chicago & Northwestern R. R. He also supervised the rebuilding of a number of bridges and located and built several new lines. In 1899 he was made superintendent of the Iowa division of the Chicago & Northwestern R. R., the operating, maintenance and motive power departments coming under his direction. In 1902 he resigned to accept the position of general superintendent of the Chicago-Rock Island & Pacific R. R. in charge of operation, motive power and maintenance between Chicago and Denver. Mr. Slifer, as steam railway expert of J. G. White & Company, will be in responsible charge of matters relating to its steam railway undertakings.

Trade Publications.

"A FEW WORDS ABOUT ELECTRIC FANS."—This is the title of a pamphlet just issued by the Crocker-Wheeler Company, in which some facts are given about Crocker-Wheeler motors for the driving of ventilating fans. Illustrations show applications of motors direct-connected to fans, and at the back of the catalogue are given some pertinent data.

VOLTAGE REGULATORS.—The Portland Company, Portland, Me., has recently issued a well illustrated bulletin devoted to the W. H. C. voltage regulator for both direct and alternating-current systems. Views of recording-voltmeter charts, with and without the regulator, serve to show the effectiveness of the device in maintaining a constant electromotive force, while copies of numerous letters received by the company prove that the regulator has given good satisfaction under service conditions.

FACTORY VENTILATION.—The subject of factory ventilation becomes very vital during the summer months. It has been proven that good ventilation is a good investment from a business point of view. Good ventilation is best secured by means of motor-driven fans and blowers. They afford convenient and economical service. Leaflets Nos. 131 and 143-A, which are published by the Northern Electrical Manufacturing Company, Madison, Wis., show numerous applications of Northern apparatus in ventilating and blowing work.

OFFICE LIGHTING BY ELECTRICITY.—In an attractive bulletin having this title, the Nernst Lamp Company, Pittsburg, Pa., presents the advantageous features of the Nernst lamp for illumination where clerical duties must be performed. Illustrations are given of several of the buildings in Pittsburg where the Nernst lamps are used. These buildings include the Farmers Bank, the Savings Bank, the Land Title & Trust Company, Whitney, Stephenson & Company, Germania Savings Bank, the Colonial Trust Company and the Frick Building.

ELECTRIC RAILWAY COUPLERS.—Edwin C. Washburn, Minneapolis, has issued a booklet devoted to a new style of car coupler suitable for electric railway equipments. The design of this coupler is on the same general lines as the latest and most improved type of Washburn coupler now used on steam roads. The coupler is entirely automatic, so that the jar from bumping cars together more than once is done away with, and it is unnecessary for any person to go between the cars in order to make the coupling. It is so designed as to place the largest amount of wear on the parts cheapest to replace.

THE PROGRESS REPORTER.—In a recent issue of the publication of the Niles-Bement-Pond Company, New York, having this title are illustrated and described numerous types of machines which the company is building, for the purpose of keeping the employees of the company and the public generally informed as to the new machines and devices which are constantly being brought out. A very interesting illustration shows a flexible shaft 1 inch in diameter and 12⅞ inches long, in which a quadruple thread was cut by a milling machine. A number of the illustrations show electrically-driven machine tools, the connection between the motor and the tool being by gears or a silent-chain drive.

SOME HOME TRUTHS.—In an attractively arranged booklet having the above title, the Philadelphia Electric Company, of 10th and Sansome Streets, Philadelphia, discusses the advantages to be derived from the use in the home of the numerous electric devices now to be found upon the market. In a fictitious conversation concerning facts, two friends talk of the electric cof-

fee urn, food and milk warmers, heating pads, electric fans, etc. With the booklet is included a post card for the purpose of suggesting that the electric company is willing at any time to investigate and report upon the exact cost for wiring the house of any one, and to quote rates for the electricity to be used. The booklet and the card should prove efficient drummers for this enterprising local company.

KELLOGG APPARATUS.—Some recent trade literature of the Kellogg Switchboard & Supply Company, Chicago, relates to the Kellogg intercommunicating systems; the Kellogg desk telephone; the Kellogg breast-plate transmitter and the Kellogg new steel telephone set. The steel telephone is said to have met with great popularity and is giving the highest satisfaction. It is made entirely of mild planished steel, and is given a fine japan finish in any desired color, the standard being black. This type of telephone can be used for two-party selective as well as on individual lines. The breast-plate transmitter is of novel design, and constructed of aluminum and enamel. The mouthpiece is of an original shape and facilitates transmission. Three of the circulars are illustrated with views of the apparatus described.

NORTHERN GENERATORS.—An excellent description of direct-current generators, manufactured by the Northern Electrical Manufacturing Company, Madison, Wis., is given in the company's bulletin No. 46, of recent issue. The bulletin is profusely and interestingly illustrated, the views being of actual installations of Northern machines, of representatives machines, and of the constituent parts thereof, details, etc. The construction of these machines is briefly but clearly described, each feature being illustrated by a view of the part, such as the field-frame, field-coils, pole-pieces, armatures, armature coils, commutator, brush-holders, etc. The final chapter is devoted to "Motor Drive in Power Plant." In this are pointed out the advantages of electric power, and various illustrations show some typical applications of Northern motors.

STEAM SPECIALTIES.—The Loew Supply & Manufacturing Company, Cleveland, Ohio, has just issued an attractive catalogue devoted to the steam specialties which it produces. Each of these is described in detail. In the Loew grease and oil separator there are provided several horizontal layers of screens, and at right angles to these is a series of vertical screens. When the steam passes into this section, the grease and oil are precipitated to grooved receiving plates. The process of separation is repeated through several sections until the steam reaches the outlet. Detail illustrations in the catalogue serve to show why it is impossible for the grease and oil to be picked up by the steam after having been separated. There are illustrated combined separators and feed-water heaters, tubular feed-water heaters, horizontal and vertical steam separators, exhaust heads, surface condensers, and adjustable stocks and dies. The characteristic features of these are modern design, high efficiency, excellent workmanship, and the best obtainable material.

DIRECT-CURRENT MACHINERY.—Bulletin No. 241 of the Triumph Electric Company, Cincinnati, Ohio, is devoted to open-type belted generators and motors, for slow and moderate speeds. The design of these machines is modern in every respect. To prevent eddy currents in the pole faces, the pole pieces are made up of laminated discs, firmly riveted together, and cast welded into the frame. The poles are fitted with a specially designed shoe, so that the proper magnetic fringe is provided, sparking at the brushes is prevented and magnetic hum eliminated. The bearings are of the best gun metal. The bulletin also contains illustrations of the Triumph direct-connected generators of both the engine and marine type. The engine-type generator is built for large power and lighting plants, while the marine-type is especially adapted for small lighting plants or where economy of floor space is desired. Bulletin No. 251, of the same company, shows in a convincing manner that Triumph apparatus enjoys the best reception where the details and methods of its manufacture were earliest appreciated, over 30 per cent. of the total output of the manufacturing plant at Cincinnati having been sold in the State of Ohio.

News of the Trade.

SALE OF WATTMETERS.—The Gregory Electric Company, Chicago, has issued a slip announcing a special sale of wattmeters. The company has just received 6000 wattmeters of all leading makes, and every one is guaranteed.

THE ANNUNCIATORS for the American Inn at Lewis and Clark Exposition, Portland, Ore., consisting of four 100-drop and four 50-drop, were furnished by the Electric Gas Lighting Company, of Boston, Mass. They are of the Ross type, Avonial style.

GRAPHIC CABLE CHART.—Mr. W. E. Rundle, of the Interborough Rapid Transit Company, New York City, has now adapted his graphic cable chart to record overhead wires as well as underground lines. The chart has already been noted in these pages.

THE STROMBERG-CARLSON TEL. MFG. CO., Rochester, N. Y., reports having closed contracts for switchboards for the following places: Ostrander, Minn.; Litchfield, Mich.; Lawnridge, Ill.; Louisville, Ky.; Columbus, Ohio; Adena, Ohio; Nome, D. D.; Plymouth, Neb.; Conoton, Ohio; Kernersville, N. C.; Clatonia, Neb.; Willshire, Ohio; Trivoli, Ill.; Brigham City, Utah; Le Mars, Ia.; Provo, Utah; Liberty, Mo.; Logan, Utah; Rochester, N. Y.; Atlanta, Ga.; Prosser, Neb.

INSULATINE is a material that is being introduced by the Insulatine Company, of 35 Broadway, New York City. It is an adhesive sealing and binding cement used by electrical workers, plumbers and gas fitters for cementing, jointing, filling and sealing. It is waterproof and airtight, and has a tensile strength of over 500 per inch, with an equal resistance against pressure. It is especially compounded for temperature changes and will not crack at zero or run above 120° Fahr. It is made in sticks 8 inches long and 1⅛ inches in diameter, each stick weighing one pound.

THE INTERNATIONAL TELEPHONE MFG. COMPANY has recently received a contract for increasing the 1000-lin equipped 2400-line multiple capacity lamp signal central energy switchboard for the Bloomington Home Telephone Company, at Bloomington, Ill. The original installation was made by the International Company three years ago, and is being increased at the present time with the same class of apparatus, which has proved an entire success.

PUMPING PLANT.—The city of Montgomery, Ala., has placed an order with Allis-Chalmers Company, of Milwaukee, for a horizontal duplex double acting plunger pump, directly driven by a horizontal cross compound Reynolds-Corliss condensing engine. This engine will have a capacity against a total net head of 254 feet of 8,000,000 U. S. gallons every 24 hours, when operated at a plunger speed not exceeding 360 feet, or 60 r.p.m., and supplied with steam at a pressure of 125 lbs. per square inch at the throttle. This pumping engine is guaranteed to develop a duty of 135 million foot-pounds for each 1000 pounds of dry steam consumed by the engine, when operated at its rated capacity under contract conditions.

CATALOGUES WANTED.—Abenheim Bros., 54 Maiden Lane, New York, have inquiries in regard to Far Eastern trade, and desire to receive from our readers catalogues in regard to the following machinery: steam engine, boiler, stroker, lathe, planer, drill press, radial drill, grinder, shaping machine, milling machine, crane, electric traveling crane, steam hammer, hydraulic press, hydraulic rail bending machine, punching machine, punching and shearing machine, centering machine, hydraulic force press, boring and turning mill, gear cutting machine, can making machine, boiler feed pump, screw machine, wood planer, sawing machine, slotting machine, bolt cutting machine, bolt heading machine, files, emery wheel, rivetting machine, hydraulic beam and angle bending machine, shearing machine, bending roll, hydraulic wheel press, tire mill.

THE LOWE ELECTRIC COMPANY made its debut on May 1, of the present year. This corporation enters the electric field well equipped to deal with the various lines of business. Particular attention has been given to organizing the different departments for the expeditious handling of electrical needs. In addition to a new and complete stock of supplies, which will be carried at 35 Dey Street, New York City, this corporation conducts a manufacturing plant located at 79 Cortlandt Street. The factory is fitted with up-to-date machinery and tools, to manufacture the specialties and patents of Mr. E. A. Lowe, and Mr. R. L. Hailey, and for the quick completion of repairs to dynamos, motors and all classes of electrical apparatus. An efficient construction department will render prompt attention in case a breakdown demands emergency service, and all classes of quick electrical construction. Its officers are Ernest A. Lowe, president and treasurer, and Robert L. Hailey secretary, both of whom have had years of experience, and are known as successful men.

ELECTRO-DYNAMIC COMPANY.—Dodge & Day, engineers and architects, Philadelphia, Pa., have been commissioned by the Electro-Dynamic Company to make a thorough examination of the existing methods in its shops at Bayonne, N. J., and submit report thereon as a basis for changes and improvements contemplated by the management. Business of the Dynamic Company has increased to such an extent that it has become an urgent necessity of speeding up the shop, or else providing more adequate facilities, or both. Some years ago the Link-Belt Engineering Company was running its shops night and day, yet were unable to keep up with its orders. Extensive additions were contemplated to its buildings, but before carrying out its idea called in Dodge & Day. As a result, 25 per cent. greater business is being done to-day on the same floor space, and night work is entirely suspended. Improved methods throughout and the introduction of the Taylor system are entirely responsible for this. The Electro-Dynamic Company hopes to accomplish the same results.

HEATING AND VENTILATION PLANT.—One of the most satisfactory of the recent heating and ventilating installations in Boston is that of the New England Conservatory of Music. Air for the main auditorium is supplied by an 8-ft. Sturtevant cone fan, direct connected to a Sturtevant motor and located in the basement. The air which the fan forces into the auditorium first passes through a heating chamber containing steam coils. Thence it passes to the auditorium through a galvanized iron duct, and is then delivered into the hall through ducts in the legs of the seats. The foul air is exhausted by means of an electrically driven 9-ft. full housing fan located on the roof. The small auditorium is supplied with air by a 110-in. steel plate fan belted to a 4½-hp motor. It is vented by a 66-in vertical shaft propeller fan set on the roof. The auditoriums and tuning rooms, with some offices, are ventilated by air supplied through special fans. The piping, heating and ventilation system was installed by Messrs. Lynch & Woodward, of Boston, and the ventilating fans were supplied by the B. F. Sturtevant Company, of that city.

THE WESTINGHOUSE MACHINE COMPANY has recently announced substantial extensions in its sales organization. These extensions are the result of the rapidly increasing business, making necessary the more thorough covering of southern and western territories. New branches have been established at Cincinnati, Denver, San Francisco, Charlotte, N. C., and Atlanta, Ga. With these added facilities the extensive mining territory of the West and cotton industries of the South may receive more active attention. The representative offices of the company are now as follows: Office New York, 10 Bridge St., Mr. L. L. Brinsmade; Boston, 131 State St., Mr. E. L. Clarke; Pittsburg, Westinghouse Building, Mr. William Bradford; Chicago, 171 La Salle St., Mr. John B. Allan; Cincinnati, 1111 Traction Building, Mr. A. A. Brown; Denver, 512 McPhee Building, Mr. C. C. Chappelle; Charlotte, N. C., So. Tyron St., Mr. Stuart W. Cramer; Atlanta, Ga., Equitable Building, Mr. Stuart W. Cramer; Philadelphia, Stephen Girard Building, M. R. Muckle, Jr., & Company; San Francisco, 614 Mission Street, Hunt, Mirk & Company.

THE MOLINE INCANDESCENT LAMP CO., Moline, Ill., has opened a New York office in charge of Messrs. Edward Williams & Co. This office is located at 136 Liberty Street. The company will also have charge of Western Pennsylvania and the New England states.

CONVENTION TRAVEL.—Many of the manufacturers and their representatives who intend to be present at the convention of the National Electric Light Association at Denver find it inconvenient to go on the special train arranged for by the committee and the same thing is probably true of a number of the delegates themselves. As an alternative, the New York Central & Hudson River Railroad and the Lake Shore & Michigan Southern Railroad from New York to Chicago and the Chicago, Rock Island & Pacific Railroad from Chicago to Denver offer splendid service. These are among the best known railroads in this country, and passengers on them are issured of the most careful attention. The trains are both luxurious and fast, so that those of our readers who are unable to avail themselves of the facilities afforded by the special train will make no mistake if they patronize the route above mentioned. Special privileges are afforded on tickets reading over the Lake Shore & Michigan Southern Railway, namely, stopover at Niagara Falls, Lake Chatauqua, Sandusky, Ohio, for Lake Erie Islands, and option of going either way by boat or rail (on Lake Erie) between Buffalo and Cleveland without extra charge. The Boston contingent will find the Boston & Albany R. R. trains convenient to reach the convention, through trains being run from that city to Chicago over the New York Central & Lake Shore, and connecting at Chicago with the fast trains to Denver.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MAY 16, 1905.

[Conducted by Rosenbaum & Stockbridge, Patent Attys., 140 Nassau St., N. Y.]

789,702. ELECTRIC SIGNAL SYSTEM; Edwin J. Adams, Waco, Texas. App. filed Feb. 13, 1904. Contact plates are arranged adjacent to the track at intervals and a pair of arms depending from the locomotive make circuits through the contact plates. The elevation of the plates varies the position of the arms and directs the current through different circuits within the locomotive to display proper signals therein.

789,715. PNEUMATIC TROLLEY CHECK; Andrew G. Cassidy, Waltham, Mass. App. filed Nov. 5, 1904. The trolley cord take-up upon the car has a pinion meshing with a longitudinally moving rack actuated by a cylinder and piston having connection with the usual air-pressure reservoirs of the brake mechanism.

789,716. TELEPHONE-TRANSMITTER; Henry P. Clausen, Chicago, Ill. App. filed Aug. 20, 1902.

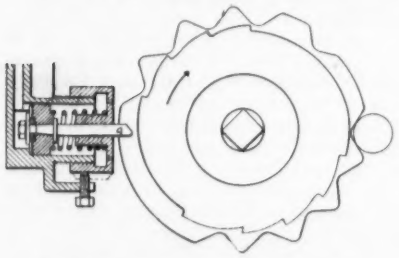
789,735. GLOW LAMP SOCKET HOLDER; Herman T. Hichhausen, Brooklyn, N. Y. App. filed Jan. 23, 1905. Is particularly adapted for supporting glow lamps on sheet metal plates for electric signs and similar purposes. The plate is perforated with a circular orifice having internal diagonally bent ears or lugs with which the socket co-acts, forming a sort of bayonet joint.

789,735. GLOW LAMP SOCKET HOLDER; Herman T. Houchhausen, Brooklyn, N. Y. App. filed Feb. 3, 1905. Relates to modifications of the above, particularly in the form of the lamp socket.

789,738. METHOD OF PROPAGATING WAVE FORMS; Dugald C. Jackson, Madison, Wis. App. filed Sept. 23, 1901. (See Current News and Notes.)

789,748. CODE-SIGNALING TELEPHONE; Charles T. Mason, Sumter, S. C. App. filed Feb. 11, 1905.

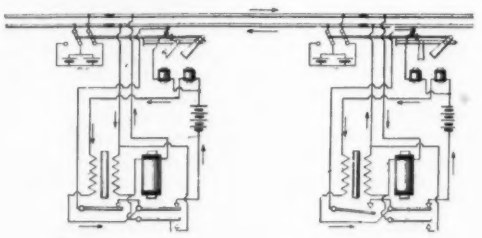
789,754. GOVERNOR FOR NON-AUTOMATIC ELECTRIC MOTOR CONTROLLERS; William J. Napier, Leichhardt, N. S. W. App. filed Jan. 6, 1904. The shaft of the motor controller is connected to a rachet wheel 3. Co-operating with this rachet wheel is a locking pawl or dog 4, thrown into action to lock the rachet wheel by pneumatic pressure in the cylinder 6. An electro-magnet in the motor circuit controls the pneumatic pressure so that the pawl 4 is only withdrawn to permit further movement of the controller when the counter e.m.f. of the motor has risen sufficiently to warrant such further movement.



789,754.—Governor for Non-Automatic Electric Motor Controllers.

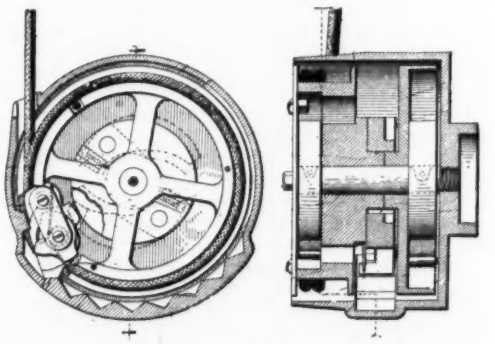
789,769. RELAY; Jesse Summers, Indianapolis, Ind. App. filed July 5, 1904. Especially adapted for use in connection with watchmen's time recorders. The relay arm has a surface against which a spring lever is impelled in a tangential direction. Motion of the relay arm permits motion of said lever over certain contact plates.

789,778. SIGNALING SYSTEM; Joseph A. Wilson, Westfield, N. J. App. filed Sept. 13, 1904. The rails of any track section are included in the circuit of a local battery which also includes a relay magnet and a solenoid coil. When a train passes on to a section the battery is short circuited and relay magnet de-energized setting the danger signal. In like manner the signal of the succeeding section is subsequently operated. Such operation of the signal shifts the pole-changer and reverses the current through a magnet coil which now opposes the current in a coil which opens a circuit to set the second signal. When the train passes out of this section the return of semaphore to normal position re-energizes the magnet which resets the signal. The signal of the previous section has already been reset when the train left that section.



789,778.—Signaling System.

789,804. TROLLEY CATCHER AND RETRIEVER; Walter W. Geiser, Altoona, Pa. App. filed Dec. 19, 1903. The trolley core reel has pawls L which fly outward by centrifugal force when the reel is revolved at excessive speed as would occur if the trolley wheel left the wire. These trip a mechanism which disengages another pawl and permits a power spring to rewind the core and prevent damage to the trolley-pole.



789,804.—Trolley Catcher and Retriever.

789,814. INTERRUPTER; Maurice K. McGrath, Antwerp, Belgium. App. filed Oct. 21, 1904. Has arms projecting from the pole pieces with a short air gap. An interrupter is arranged to bridge the air gap and open a circuit when attracted.

789,822. AUTOMATIC ELECTRIC CURRENT REGULATOR; Thomas A. Swarts, Columbus, O. App. filed Feb. 29, 1904. A solenoid operates a core having an arm sliding over resistance contacts to cut in resistance as the load falls off. At the zero position another contact is made to cut storage batteries into the circuit.

789,830. CABLE HANGER; Nils A. Zetterlund, Duluth, Minn. App. filed Nov. 25, 1904. The cable hanger is made of sheet metal straps or bands hinged together and adapted to be stamped up in a die-press. Details.

789,832. CANOPY INSULATOR; Edmund E. Bechtold, Chicago, Ill. App. filed Oct. 20, 1904. For the purpose of supporting electric chandeliers and canopies from ceilings so as to insulate the same, the two parts have sheet metal rings or collars preferably beaded, leaving an annular space between them which is packed with the insulating material.

789,886. LIGHTNING ARRESTER; Guy H. Short, Stillwell, Ill. App. filed Aug. 1, 1904. A lightning arrester formed of wire and sheet metal parts. Details.

789,914. ELECTRIC SWITCH; Frederick Huffer, New York, N. Y. App. filed Oct. 31, 1904. Adapted for use with electric candles, table lamps, etc. An annular collar has sheet metal wings adapted to contact with the circuit terminal plates when the collar is properly manipulated.

789,975. ELECTRIC SWITCH; Gustave L. Herz, New York, N. Y. App. filed Oct. 7, 1904. Particularly adapted for automobiles in which a plug switch is employed. A lever withdraws the plug to its open circuit position, without completely removing it. But the plug may be completely removed when desired.

789,985. TELEPHONE CUT-OFF; Herbert Manring, Weatherby, Mo. App. filed July 14, 1902.

790,095. ELECTRIC SIGNALING SYSTEM; Samuel M. Young and Fitzhugh Townsend, New York, N. Y. The track is divided into sections and the rails thereof are maintained at alternating potential difference, transmitters being used to operate the usual relay magnets. Impedence coils are used as rail bonds.

790,100. SAFETY DEVICE FOR MOTOR STARTERS; Frederick G. Bill, Long Island City, N. Y. App. filed Feb. 21, 1905. The motor circuit includes a solenoid magnet which is released to open the circuit when the latter has been opened at the main switch. The circuit cannot then be reclosed until the solenoid armature has been rethrown by hand or other means.

790,103. COMBINED ANNUNCIATOR AND JACK FOR TELEPHONES; Daniel Wallace Campbell, La Crosse, Wis. App. filed July 25, 1903.

790,152. INCANDESCENT LAMP SOCKET; Guy H. Proctor, Somerville, Mass. App. filed May 10, 1904. A Z-shaped part having a contact plate is attached to the usual threaded shell or socket of the lamp. The circuit closing turn button presses a cam into contact with this plate.

790,179. WIRELESS TELEGRAPHY; Ferdinand Braund, Strassburg, Germany. App. filed Nov. 4, 1904. (See Current News and Notes.)

790,189. ELECTRIC ALARM SYSTEM; Hippolyte M. Cooper, Coopers Plains, N. Y. App. filed Oct. 15, 1904. The fire alarm circuit includes a relay which energizes a local circuit magnet controlling the air valve of the fire whistle.

790,193. TELEGRAPHY; Patrick B. Delany, South Orange, N. J. App. filed June 30, 1902. The operation of the transmitter starts in motion the usual paper reels of the receiving station, and a stylus prints on the chemically prepared paper strip as with the original Bain chemical telegraph. The contact stylus has special features of construction.

790,241. ANTISEPTIC MOUTHPIECE FOR TELEPHONES OR THE LIKE; Walter Wright, San Francisco, Cal. App. filed May 12, 1904.

790,250. APPARATUS FOR INCREASING THE DISCHARGE ENERGY OF ELECTRICAL-VIBRATION SYSTEMS; Ferdinand Braund, Strassburg, and Ragnar Hakan Rendahl, Berlin, German. App. filed April 22, 1904. (See Current News and Notes.)

790,258. ALTERNATING-CURRENT MOTOR; Albin May, Berlin, Germany. App. filed July 29, 1903. (See Current News and Notes.)

790,262. INDICATING DIAL FOR ELECTRIC SWITCHES; Charles G. Perkins and Nathan W. Crandall, Hartford, Conn. App. filed Oct. 19, 1904. The turn button of the switch has a plate thereon which exposes characters through an orifice in the surrounding casing to designate whether the switch is on or off.

790,267. ELECTRIC CLOCK SYSTEM; John Stein and Albert N. Stein, New York, N. Y. App. filed June 22, 1904. The master clock has a so-called "ratchet wheel" which makes contacts through the circuit of the secondary clocks, the ratchet wheel acting as a cam upon a pivoted contact lever for this purpose. The secondary clock has 24 sliding pins which are pushed out successively to set in operation the usual alarm gong.